

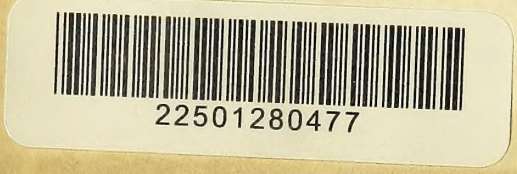
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A

SYSTEM OF SURGERY;

PATHOLOGICAL, DIAGNOSTIC, THERAPEUTIC, AND OPERATIVE.

BY

SAMUEL D. GROSS, M. D.,

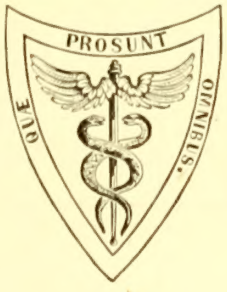
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ILLUSTRATED BY

NINE HUNDRED AND THIRTY-SIX ENGRAVINGS.

IN TWO VOLUMES.

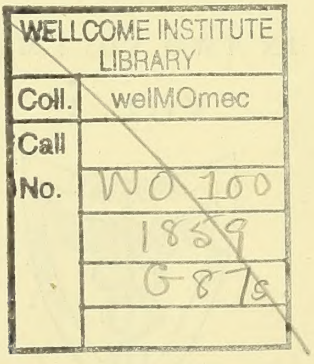
VOL. I.



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TO

THE NUMEROUS PUPILS

WHO, DURING THE LAST QUARTER OF A CENTURY,

HAVE ATTENDED HIS LECTURES,

AND WHO ARE NOW SETTLED IN EVERY SECTION OF THE UNITED STATES

IN THE

HONORABLE PURSUIT OF THEIR PROFESSION,

These Volumes,

DESIGNED TO ILLUSTRATE ONE OF THE MOST IMPORTANT AND VALUABLE BRANCHES OF THE HEALING ART,

ARE RESPECTFULLY AND AFFECTIONATELY INSCRIBED

BY THEIR FRIEND,

THE AUTHOR.

PREFACE.

THE object of this work is to furnish a systematic and comprehensive treatise on the science and practice of surgery, considered in the broadest sense; one that shall serve the practitioner as a faithful and available guide in his daily routine of duty. It has been too much the custom of modern writers on this department of the healing art to omit certain topics altogether, and to speak of others at undue length, evidently assuming that their readers could readily supply the deficiencies from other sources, or that what has been thus slighted is of no particular practical value. My aim has been to embrace the whole domain of surgery, and to allot to every subject its legitimate claim to notice in the great family of external diseases and accidents. How far this object has been accomplished, it is not for me to determine. It may safely be affirmed, however, that there is no topic, properly appertaining to surgery, that will not be found to be discussed, to a greater or less extent, in these volumes. If a larger space than is customary has been devoted to the consideration of inflammation and its results, or the great principles of surgery, it is because of the conviction, grounded upon long and close observation, that there are no subjects so little understood by the general practitioner. Special attention has also been bestowed upon the discrimination of diseases; and an elaborate chapter has been introduced on general diagnosis.

The work, although presented, as its title indicates, as a formal and systematic treatise, is founded upon the courses of lectures which it has devolved upon me to deliver during the last twenty years; first in the University of Louisville, for a long time the most flourishing medical school in the Southwest, and more recently in the Jefferson Medical College of this city, in which I had the honor, in 1828, to receive my degree. During all that period, I have been unceasingly devoted to the duties of an arduous practice, both private and public; to the study of the great masters of the art and science of medicine

and surgery; and to the composition of various monographs having a direct bearing upon a number of the subjects discussed in these volumes. The work should, therefore, be regarded as embodying the results of a large personal, if not of a ripe, experience, of extensive reading, and of much reflection; in a word, as exhibiting surgery as I myself understand it, and as I have, for so many years, conscientiously taught it. If, upon certain points of doctrine, I have been obliged to differ from co-laborers of acknowledged authority and of the highest professional eminence, it is because I have found it impossible to do otherwise. As Luther said at the diet of Worms, "hier stehe ich, ich kann nicht anders," so I may declare that what I have here written, I have written under a solemn conviction of its truth, though certainly not without a strong sense of my fallibility and shortcomings.

In the composition of a work so extensive as this, comprising so many and such diversified topics, no man, however great his opportunities for observation, could possibly rely entirely upon his own resources; for there are certain diseases, and also certain accidents, so infrequent in their occurrence as hardly to come under notice even once in a long lifetime; and it is, therefore, only by availing himself of the recorded experience of the profession that an author can hope to be able to communicate full and satisfactory information respecting them. I have, accordingly, made free use, wherever this was deemed necessary, of the labors of my contemporaries, both among systematic writers and the contributors to the periodical press of this and other countries. To the excellent works of Erichsen, Miller, and Fergusson, so well known on this side of the Atlantic, I have frequently referred as embodying the latest resumé of the art and science of surgery among our British brethren; while I have not neglected to consult some of the more recent treatises in the French and German languages, as well as numerous monographs.

Of the engravings which adorn the volumes, nearly four hundred are original, the remainder having been borrowed from different writers, as Liston, Cooper, Fergusson, Marcet, Bennett, Miller, Curling, Tamplin, Lawrence, W. Jones, Dalrymple, Pirrie, Erichsen, and Mütter. To Mr. Gemrig, the eminent cutler, I am indebted for numerous illustrations, many of them specially prepared for the work, of the latest and most approved styles of instruments. Mr. Kolbé, another excellent manufacturer, has also placed me under obligations for several similar favors.

To Professor Wright, of Montreal, Dr. E. Williams, of Cincinnati, Dr. Lente, of New York, and Dr. Packard, Dr. James Darrach, and Dr. Walter F. Atlee, of this city, my acknowledgments are due for

various favors received during the progress of the work. To Dr. Bozeman, of Alabama, a valued friend and former pupil, I am indebted for a complete series of drawings illustrative of his peculiar mode of operating for the cure of vesico-vaginal fistule. The index, which will be found to be unusually elaborate, has been prepared, with great care, by my son, Dr. S. W. Gross.

The mechanical execution of the work will, I doubt not, meet with general approval. The publishers have spared neither pains nor expense to render it as perfect, in this respect, as possible. To Messrs. Baxter and Harley, engravers, and Mr. Collins, printer, my best thanks are due for the able manner in which they have executed their respective tasks.

S. D. GROSS.

Jefferson Medical College,
Philadelphia, July 8, 1859.

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PART FIRST.

GENERAL SURGERY.

A

SYSTEM OF SURGERY.

PRELIMINARY OBSERVATIONS.

Under the division of General Surgery, I shall consider, at some length, the leading facts illustrative of the great principles of surgical diseases and injuries, and of the operations necessary for their relief, removal, or cure. Beginning with the subjects of irritation, sympathy, and congestion, as intimately concerned in the production and maintenance of many of the most common and interesting morbid phenomena, I shall pass successively in review all that relates, generally speaking, to inflammation and its effects, textural changes, new formations, whether benign or malignant, wounds, and poisons; as all these affections are liable to occur in every organ, tissue, and region of the body. To this division of the work, also, naturally appertain the subjects of general diagnosis, surgical instruments, and other appliances; and, lastly, anæsthetics, or the means of averting pain during the performance of surgical operations, and in the reduction of hernia, fractures, and dislocations. Such an arrangement is suggested not less by common sense than by sound experience; for it is just as necessary in surgery to pass from the known to the unknown, or from the more simple to the more complex portion of the various topics which fall within its province, as it is in the study of mathematics, or any other abstruse science.

The above subjects being disposed of, we shall come to that of Special Surgery, embracing an account of the various surgical diseases, injuries, and malformations of particular organs, tissues, and regions of the body. The general principles, or great doctrines of surgery being understood, a knowledge of the various topics discussed in this part of the work will be a comparatively easy task.

The word surgery is a corruption of chirurgery, derived from a Greek compound, literally signifying manual procedure. Hence, surgery was for a long time regarded merely as a kind of handicraft, fit to be exercised only by men of inferior attainment, ability, and skill. For many ages, in fact, the chirurgeon was nothing but the servant of the physician, without whose advice and direction he was never permitted to perform any operation, however simple. He had no agency whatever in preparing the system for the approaching ordeal, nor any

hand in the after-treatment of the case. His task was completed when he had made his incisions, spilt a certain quantity of blood, and relieved the suffering organ from impending danger, by restoring it to its natural position, or ridding it of foreign substances. His occupation was a mere mechanical one; and, although there can be no doubt that he often possessed great manual dexterity, yet it is obvious that his very education unfitted him for the exercise of the more lofty duties of his profession. The contrast between the surgery of former times and that of the present day, forms one of the brightest pages in the history of human progress and human achievement. Redeemed and purified by the genius of modern discovery, it is no longer a handicraft, but a science and an art, reduced, if not to perfection, to principles as accurate as any that have been introduced into the study of the natural sciences in general, of which, in fact, it forms one of the most interesting and useful branches.

Surgery, thus improved and perfected, can no longer be separated from medicine; any attempt to produce such a severance must prove abortive. They are, in point of fact, one and the same science, and therefore indivisible. No surgeon can practise his profession with credit to himself, or benefit to his fellow-creatures, if he is not an enlightened physician, or deeply grounded in a knowledge of the great doctrines of disease. He may, it is true, be an excellent operator, a good mechanic; but unless he is an able pathologist and therapeutist, he is unworthy to be intrusted with the health and life of the humblest citizen that may be so unfortunate as to fall into his hands.

Surgery has occasionally been separated into two distinct branches, medical and operative; the former treating, as the name implies, of the principles of the science, or of the nature of disease, and of its management by drugs; the latter, of the various manual, instrumental, and mechanical procedures considered necessary for the cure of external affections, and the repair of mutilated structures. Upon this plan have been constructed several very excellent modern works, as those of Liston, Miller, Fergusson, Sédillot, Blasius, Velpeau, Pancoast, and Smith; but it is questionable whether such a manner of treating the subject is altogether judicious, as it is certainly calculated to invest the operative part of surgery with a degree of importance that does not legitimately belong to it, and which may lead, especially on the part of the young practitioner, to erroneous conceptions of the true province and dignity of surgery, considered as a science and an art. A work on surgery, or, indeed, on any subject, without principles, may be compared to a vessel at sea without helm or rudder to guide it to its place of destination. If, therefore, there is any one part of the present treatise upon the study of which I would insist more than upon that of any other, it is that which treats of the great principles of surgery, as comprised under the head of inflammation, wounds, morbid deposits, new growths, and morbid poisons. Let the student make himself fully acquainted with these details, and he can hardly fail to become an enlightened and judicious practitioner. Let him learn principles, and he will be able to form a more just appreciation of what is merely operative.

CHAPTER I.

IRRITATION, SYMPATHY, AND IDIOSYNCRASY.

It is perhaps impossible, in the present state of the science, to offer any satisfactory definition of irritation, or to assign to this expression its true pathological and practical import, without an intimate knowledge of sympathy, or of those various and mysterious relations, anatomical and functional, which exist among the different organs and tissues of the body, and which thus serve to bind them all up into one harmonious, uniform, and connected system. Irritation and sympathy are not only closely associated together, in all the great operations of the economy, but they so constantly run into each other, as to render it impossible always to draw a precise line of distinction between them, or to determine what part they respectively play in the production, propagation, and effect of disease. Much of what has been written upon these topics has necessarily been exceedingly obscure, depending not merely upon the intrinsic difficulties of the subject—great and perplexing as they certainly are—but upon the unphilosophical manner in which they have, for the most part, been discussed by surgeons, whose authority has not only never been disputed, but regarded with a blind devotion as surprising as it has generally been unaccountable. To arrive at any other conclusion from an attentive perusal of their writings, is impossible. Every page, nay, almost every paragraph, bears testimony to the fact that they have constantly confounded together affections of a very different, and even of an opposite nature; that they have, in numberless instances, violated their own definitions of disease; and that they have attempted to establish systems of treatment, based upon principles of the most erroneous and unfounded character.

What is irritation? Is it an entity, or a mere myth, a certain undefinable something, which no one can see, but which every one may recognize by its effects? Perhaps the best definition we can give of it is, that it is a disordered state of the nerves of the affected part, attended with more or less pain and functional disturbance, but not with inflammation, although it may lead to that result, if not timeously arrested; in other words, irritation is a disease whose predominant symptom is nervous derangement. Viewed in this light, it may be considered as bearing the same relation to the nervous system that inflammation bears to the vascular; the one consists essentially in disordered sensation, the other in disordered circulation; in the one there is pain, but it is the pain of perverted sensation, in the other there is pain also, but it is the pain of inflammation, as is evinced by the con-

comitant vascular injection, discoloration, and tumefaction, which are wanting in the former. The differences between irritation and inflammation have sometimes been defined by stating that the former terminates where the latter begins; just as congestion may be said not to be inflammation, but the prelude to that affection. Both may be merged in the latter disease, and may, consequently, serve to augment and perpetuate it.

Irritation may be of limited extent, as when it is confined to one particular organ, or part of the body, and is then said to be local; on the other hand, it is sometimes widely diffused, manifesting itself at numerous points, and constituting what is termed general irritation, of which one of the most familiar illustrations occurs in nervous shock, consequent upon severe injury. It is also divided into direct and indirect; in the former case, the irritation displays itself at the place of the morbific impression; in the latter, on the contrary, it occurs at a situation more or less remote, sympathy and reflex action being the agents of its transmission. An example of direct irritation is afforded in the intolerance of light which results from over-fatigue of the eye, and of the indirect in the convulsions which supervene upon the presence of worms in the alimentary canal, the irritation being communicated here from the nerves of the bowels to the spinal cord, or the cerebro-spinal axis, and from thence to the nerves of the voluntary muscles, the seat of the spasmodic action.

Local irritation may manifest itself in a great variety of ways and circumstances. It is generally excited by the contact of some extraneous substance, or agent, foreign to the part, and, therefore, a source of offence to it. Thus, a drop of alcohol, falling upon the eye, instantly produces pain, and injection of the conjunctiva, with an abundant flow of tears; the organ resents the aggression, and the consequence is a marked perversion both of sensation and circulation, which, the exciting cause ceasing to operate, soon passes off, the parts regaining their comfort and accustomed action; or, the cause continuing in play, violent and even destructive inflammation may succeed, the minor evil being merged into the major. A pinch of snuff will excite sneezing by the irritation which its presence induces in the pituitary membrane; on the same principle, some emetics cause vomiting, some cathartics purging, and some diuretics an increased secretion of urine. When the hand is held near a hot stove, or rubbed with spirits of ammonia, the skin presently shows signs of irritation; its sensibility is perverted, it burns and stings, and becomes intensely red. All these, and numerous other analogous cases that might be easily adduced, if it were necessary, are examples of local irritation, or of perverted nervous action, accompanied by vascular determination, but not by inflammation, although such an event is certain to occur, if the exciting cause of the irritation be not promptly removed.

Indirect, or reflex irritation, like the direct, also displays itself in different ways, and not unfrequently in a manner not less singular than perplexing, defying all effort at explanation. The subject offers a wide field for contemplation and study. Time and space will permit me to

glance only at a few of the more prominent facts which naturally connect themselves with such a discussion. To do anything even like partial justice to the subject, it will be proper to consider it in relation to the principal organs of the body, a procedure which will necessarily bring up the question of sympathy, as a knowledge of the latter is indispensable to a correct appreciation of the former, and conversely.

It would be out of place in a work of this kind to inquire into the nature of sympathy. All that we know respecting it is, that there exists, both in health and in disease, an intimate relationship between certain organs and tissues, the result either of a continuity of structure, similarity of tissue, or of ties, of which anatomy and physiology have failed to point out the true character. In health, this action is carried on so imperceptibly as to escape attention; but, whenever there is any serious disorder of the system, it manifests itself at every point, serving at once, at least in many cases, to indicate the nature of the lesion, and the particular tissues, or set of textures, which it implicates. It is not difficult to account for the sympathy that exists between parts that are united together by continuity of structure, as, for instance, the eye and nose, or the bladder and urethra; or by similarity of structure, as the fibrous membranes, whose diseases, as gout and rheumatism, are sometimes suddenly transferred from one to another; but, in other cases—and these constitute some of the most interesting and important exceptions—no connection of any kind can be traced, and we are therefore left in doubt in respect to its real character. It is only, then, by studying these effects, as they exhibit themselves in different parts of the body, and under different circumstances, that our knowledge of them can be made practically available at the bedside.

1. *Brain.*—The brain, from its elevated position in the scale of organs, and its importance to health and life, is subject, in a remarkable degree, to the causes which develop and influence irritation. Connected, either directly or indirectly, with every other organ and tissue of the body, its functions are liable to be disturbed in every variety of way, and in every possible degree, from the most simple and almost imperceptible departure from the normal standard to the most complete and thorough perversion, amounting, at times, to total annihilation of sensation. Hence, it is not surprising that while the brain is itself a source of irritation to other parts, it should, in its turn, be more or less seriously affected by irritation having its seat in remote structures operating upon it through sympathy, or reflex action. It is in this manner that are developed many of the most distressing diseases of the cerebrum and cerebellum, and, also, as a natural consequence, of the mind; and, what is remarkable is, that some of the most disastrous lesions often have their origin in, apparently, the most trivial cerebral irritation, which, but for neglect or ignorance, might usually be relieved by the most simple treatment. The arachnitis of infancy generally begins in reflex irritation, which has its seat in the bowels, stomach, liver, skin, or gums, fretted, perhaps, by the pressure

of an advancing tooth. Such cases are of constant occurrence in this country, during our hot summer months, and there are none which are more justly dreaded by the practitioner. The influence of this kind of irritation is often forcibly exhibited in traumatic delirium, or that excited state of the brain consequent upon accidents and operations, especially in subjects of intemperate habits and of a nervous temperament; the brain appears to be in a state of the utmost tension from pent-up irritability, which nothing but the most liberal use of anodynes can generally control; all the symptoms are such as to preclude the idea of the existence of inflammation in the cerebral substance, nor is it by any means certain that there is always gastritis, although usually there is marked derangement of the stomach. In disorder of the uterus, the brain is often affected by reflex irritation, as is plainly evinced by the eccentric phenomena which so generally attend hysterical diseases.

On the other hand, disease of the brain is often productive of serious irritation, or disease in other parts. Thus, after concussion of this organ, it is by no means uncommon, after the main symptoms of the accident have subsided, to meet with paralysis of one side of the face, occasional vomiting, constipation of the bowels, irritability of the bladder, or disease of the sphincters, causing involuntary discharges of urine and feces.

The sympathetic relations between the cerebellum and testes have always been a matter of observation, and afford a ready explanation of the occurrence of certain diseases, which, but for a knowledge of this fact, would be impossible. Military surgeons long ago noticed that wounds of the occiput, even when they do not involve the substance of this portion of the brain, are often followed, at variable periods after recovery, by atrophy of the testicles. Injuries of the cerebellum have been known to be succeeded within a short time after their infliction by the most violent sexual excitement. In a case of gunshot wound, the particulars of which have been related to me by Dr. Donne, of Kentucky, this sexual irritation existed in a most remarkable degree. The man was twenty-five years of age, and the ball, discharged from a common rifle, penetrated the skull near the lambdoidal suture, whence it passed obliquely downwards and backwards, lodging, there was every reason to believe, in the cerebellum. The reaction, which was very slow, was attended with excessive excitement of the genital organs. Intense priapism supervened on the fifth day, attended with the most extraordinary salacity, which formed the all-absorbing topic of his remarks during his semilucid intervals up to the time of his death, nine days after the receipt of the injury. Nocturnal pollutions and the habit of onanism, in their most degrading forms, are often excited and kept up by a diseased state of the brain operating prejudicially upon the testes and seminal vesicles. The effect may be produced simply by inflammation of the cerebral tissues, or by the pressure occasioned by some morbid growth, as a fibrous, scrofulous, or encephaloid tumor.

2. *Spinal Cord.*—The study of the sympathies and irritations of the spinal cord naturally follows that of the brain. Connected as this cord is,

on the one hand, by the nerves which are detached from its substance, with the organs of volition and of special sensation, and, on the other, by the anastomoses of these same nerves with those of the great trisplanchnic system, its sympathies and relations are as universal as they are close and intricate. Hence whatever has a tendency to derange these consentaneous movements, must necessarily be a source of disease, often of a wide-spread, if not of an all-absorbing character. Concussion, for example, of the spinal cord, when not immediately followed by death, is generally productive of excessive prostration of the vital powers, hardly less extensive and fatal than that of the brain itself. Life often hangs literally for hours upon a mere thread; the face is ghastly pale, the pulse weak and fluttering, the breathing hardly perceptible. In the milder forms, the mind is frequently disordered for days, the bladder is excessively irritable, the bowels are costive, the eye sees objects confusedly, and the ear is incapable of accurately noting sound. There are many diseases which may induce spinal irritation; I shall only allude to inflammation, ulceration, and displacement of the uterus, the practice of self-pollution, constipation of the bowels, and chronic gastric disorder. On the other hand, spinal irritation is capable of sending its baneful influence through every portion of the system, deranging the functions of every organ, and causing a train of phenomena frequently as distressing as they are enigmatical, or difficult of interpretation. Nervous headache, hemicrania, partial paralysis, imperfect sight, partial aphonia, embarrassed respiration, palpitation of the heart, gastric irritation, vitiated appetite, costiveness, and disorder of the menstrual secretion are often directly traceable to disease of the spinal cord and its envelops; and no practitioner can make much progress towards a cure in these affections without bearing in mind the sources whence they spring. The renal secretion is often greatly affected by disease and injury of the spinal cord, and a very common effect of such lesions is a tendency to various deposits, especially the lithic and phosphatic. The bladder is also apt to suffer under such circumstances; becoming irritable, inflamed, and the seat of calculus, especially when the spinal cord has been severely concussed, wounded, or compressed. Many cases of neuralgia, gout, and rheumatism owe their origin, there is reason to believe, to disorder of the spinal cord, or the spinal cord and brain.

3. *Nerves.*—The nerves, those agents which convey to and from the brain and spinal cord the impressions made upon the various organs of the body, are themselves not unfrequently the seats of serious diseases and injuries, serving to modify and pervert their functions. A spiculum of bone, a ball, or the point of a needle, pressing upon a nerve, or partially embedded in its substance, has often been productive of epilepsy, partial paralysis, loss of sensation, and other unpleasant symptoms, which promptly vanished upon the removal of the foreign body.

4. *Heart.*—As the heart is sympathetically connected with every portion of the body, so there are few diseases which are not capable

of exerting a prejudical influence upon its action, exalting it at one time, and depressing it at another. It may be irritated and fretted in a thousand different ways; now by this thing and now by that; at one time by the solids, and at another by the blood, its natural and proper stimulus. Both the surgeon and physician daily witness examples of these disturbing agencies, and prepare to meet them by the judicious exercise of their clinical knowledge, often sadly tried by the perplexing and dangerous features of the case. There is no organ, the brain hardly excepted, whose action varies so much as that of the heart within the limits of health, and none which suffers more frequently and profoundly in disease and accident. The blood which, on the one hand, serves to animate and rouse it, and which, on the other, it is obliged at every moment to propel to every portion of the body, is itself one of the greatest sources of irritation to which it is so constantly exposed. At one time the cause of the irritation perhaps is plethora, at another anæmia; in one case it may be due to an undue proportion of saline matter, in another to the presence of some extraneous substance. Among the more prolific sources of cardiac irritation are disorder of the digestive apparatus, mechanical obstruction to the circulation, however induced, mental emotion, and derangement of the liver, uterus, and kidneys.

In injuries, derangement of the sympathetic relations of the heart is of constant occurrence, exhibiting itself in various forms and degrees, from the slightest disorder of its functions to almost complete annihilation of its muscular powers. In shock, the pulsations of the heart are weak and fluttering; in compression of the brain, slow and laboring; in hemorrhage, thrilling and vibratory; in plethora, strong and full; in anæmia, quick, jerking, and accompanied with a peculiar systolic murmur.

Irritation of the heart is often aroused by compression of the cardiac nerves by various kinds of tumors, by aneurism of the great vessels, and by diseases resident in its own tissues, causing them to act in an irregular and imperfect manner.

As the heart's action may be disordered by various diseased states of the body, so may this organ, in its turn, occasion derangement and irritation in other structures, leading not unfrequently to violent inflammations which no remedial measures, however judiciously applied, can always arrest and subdue. These disordered states form a wide field of study, which it would be out of place to pursue in a work of this kind. The intelligent reader will not fail to appreciate their pathological and practical import.

5. *Lungs.*—The action and reaction which are so incessantly going on between the lungs and the rest of the system cannot fail to strike the most superficial observer. From the importance of their functions, and their extensive sympathetic relations, these organs are subject to numerous and diversified changes, the influence of which, upon the general health, can only be duly estimated by a profound study of the subject. Whatever seriously affects the functions of the more important structures is sure, sooner or later, to exert an unfavorable impres-

sion upon the lungs, disordering the respiratory movements, and untowardly interfering with the aeration of the blood, or the formation of oxygen, and the elimination of carbonic acid. Hence, a perfectly healthy state of these organs is a matter of paramount importance in the treatment of every case of injury and disease that may come under the observation of the practitioner. Among the more common objects of attention with this view, should be a pure state of the atmosphere, the use of wholesome food, and the correction and improvement of the secretions, without which our best directed efforts will often fail to avert irritation and disease, or to combat them successfully when their development has been unavoidable.

6. *Stomach.*—The stomach, possessing a wide range of sympathy, is often the seat, not less than the cause, of severe irritation. Food and drink are the ordinary stimulants of this organ, and when taken in proper quantity, of proper quality, and at proper intervals, seldom fail to prove wholesome. But when the laws of digestion are contravened by dietetic debauch and indiscretion; or, in other words, when the stomach is overloaded with indigestible articles, nausea and vomiting, with more or less cerebral and other disturbance, are the necessary and inevitable consequences. In children and delicate nervous females, such abuse often manifests its effects in the most violent convulsions, from the irritation it provokes in the cerebro-spinal axis and the nerves which are distributed to the voluntary muscles. An overloaded stomach frequently brings on a severe attack of asthma, palpitation of the heart, indistinctness of vision, and distressing noises in the ears.

Affections of the œsophagus often create excessive irritation of the stomach, manifesting itself in nausea and vomiting. Examples of this morbid sympathy occur in scirrhus of the œsophagus, as well as in ulceration and ordinary stricture of that tube. I have seen a foreign body, as a common cent, lodged in the œsophagus of a child, keep up nausea and vomiting until it was extracted. The irritation of the stomach, produced by tickling the fauces, is well known to every one. On the other hand, the œsophagus is liable to suffer very seriously from disease of other parts of the body. Thus, spasmodic stricture of the tube, sometimes of an exceedingly severe and intractable character, may be produced by disorder of the stomach, bowels, uterus, or spinal cord, which can only be relieved by addressing our remedies to the seat of the primary affection.

7. *Bowels.*—Disorder of the bowels is a prolific source of irritation, exhibiting itself in different viscera and tissues; for there are few organs whose sympathetic relations are of a more varied and extensive character. We have already alluded to the effects occasioned by the presence of worms in the alimentary canal; the retention of irritating matter often produces similar impressions upon the great nervous centres, followed, in many cases, especially in infants and delicate nervous persons, by violent convulsions, disease of the arachnoid membrane, and palpitation of the heart. Itching of the nose, and various disor-

ders of the lips, tongue, and fauces, are frequently directly chargeable to dyspepsia, constipation, and other gastro-enteric derangement. What is called sick headache affords a familiar illustration of cerebral irritation dependent upon disorder of the stomach and bowels, or of these organs and of the liver. Costiveness never fails, when long continued, to oppress the brain, and produce a sense of general malaise.

8. *Rectum.*—There is an intimate sympathetic connection between the bladder and the rectum; also between the urethra and the lower bowel. In dysentery, hæmorrhoids and fissure of the anus, strangury and spasmodic retention of urine are by no means uncommon, and sometimes constitute a source of real suffering. The ligation of a pile not unfrequently compels the surgeon to use the catheter for drawing off the urine; and I have known the vesical irritation in such a case to continue for several days. The same affections not unfrequently produce spasmodic stricture of the urethra.

9. *Teeth.*—A very lively sympathy exists between the teeth and some of the other parts of the body; more intimate and extensive than would at first sight seem possible. Children, from the pressure of the teeth upon the gums, are extremely liable, especially during our hot summer months, to vomiting, diarrhœa, fever, and convulsions. Arachnitis occasionally supervenes upon difficult dentition; and certain affections of the skin, as eczema and porrigo, are frequently directly traceable to its effects, and rendered obstinate, if not temporarily incurable, by its persistence. A heated and tumid state of the gums, with thirst and redness of the skin, should be promptly met by the free division of these structures; otherwise, what is originally a mere irritation of the brain, stomach, or bowels, may soon be transformed into a fatal inflammation.

A decayed tooth, even when it does not itself ache, will often cause severe pain in the face, temple, neck, throat, or ear; generally, but by no means always, on the corresponding side, doubtless because all these parts are supplied by nerves coming from the same sources. When the ear is involved, the pain is propagated along the nervous cord of the tympanum, a filament of the second branch of the fifth pair of cerebral nerves. A carious tooth occasionally creates violent pain in a sound one, though at a distance from it; and the suffering ceases the moment the offending tooth is extracted. I have known a severe attack of pleurodynia kept up by a diseased tooth; the patient was bled and purged, but relief came only with the removal of the affected stump. Enlargement of the lymphatic ganglions of the neck, ulcers of the chin, epilepsy, hysteria, dyspepsia, and various other affections, sometimes of a very obstinate and distressing character, may be produced by carious teeth. It is difficult to conceive how a diseased tooth could keep up an attack of rheumatism of the hip, and yet the possibility of such an occurrence is established by some well-authenticated cases. Dysmenorrhœa has been cured by the extraction of several of the large grinders; and writers refer to instances of intermittent fever which were relieved in a similar manner, after

the fruitless employment, for several months, of bark, and other remedies.

10. *Liver.*—The sympathetic relations of the liver are at once numerous and diversified, and any disturbance in them is generally productive of irritation in a number of the more important organs, especially the stomach, bowels, brain, heart, and lungs. The skin also frequently suffers in consequence of hepatic derangement, and, conversely, the liver from disorder of the cutaneous surface. Various medicines, as well as different kinds of food, are capable of seriously disturbing the functions of this organ; and it is well known that its secretions are often materially disordered by the direct influence of anxiety or strong mental emotion. An attack of jaundice is sometimes instantaneously produced by severe fright. The timid duellist and the affrighted soldier often suffer from this kind of irritation. Hepatic abscesses not unfrequently follow upon injury of the skull and brain; and, on the other hand, disease of the liver occasionally provokes serious cerebral irritation. Dyspnœa, palpitation of the heart, nausea, flatulence, and vomiting, are common effects of disease of this viscus. Pain in the top of the right shoulder has long been recognized by physicians as a symptom of hepatitis. Violent shock is occasionally followed by total suppression of bile; and the passage of a gall-stone always causes intense gastric irritation.

11. *Kidneys.*—The kidneys have important sympathetic relations with different parts of the body, manifesting themselves in various forms of irritation, some of which are easily explicable, while others are involved in impenetrable obscurity. Thus, it is easy to understand why a renal calculus should excite pain in the urethra, and a desire to urinate, simply by remembering that there is here a direct continuity of structure, the mucous membrane of the kidney being prolonged as far as the head of the penis; but it is very difficult, if not impossible, to comprehend why a foreign body of this kind, as it descends along the ureter, should occasion retraction of the testicles, and excessive irritability of the stomach. Severe injuries, involving great shock of the system, are often followed by total suppression of urine; and, on the other hand, there are various affections in which this fluid is poured out in enormous quantity.

12. *Bladder.*—The bladder also is variously affected by disturbance of its sympathetic relations. After injuries, as compound fractures and severe operations, the organ is often incapable of contracting upon its contents, thus necessitating the employment of the catheter; its perceptive faculties are suspended, and a few days usually elapse before they are reinstated, so as to enable the patient to pass his water without assistance. Stone in the bladder causes pain and burning in the head of the penis, and retraction of the testicle. Sometimes the pain is felt in the knee, heel, and foot; and a curious case has been reported where it was seated in the arm. For a long time the professional attendants were unable to discover the cause of the suffering;

but at length, the man complaining of vesical trouble, a sound was introduced, when he was found to have stone, the removal of which put at once a stop to the unpleasant symptom. A very common effect of stone in the bladder is spasm of the sphincter muscle of the anus, which is often so great as to interfere with the passage of the finger. The introduction of a bougie into the urethra occasionally induces swooning, followed by violent rigors and high fever; and cases occur, although they are not common, of severe pain being excited by such an operation in the extremity of the coccyx. In the female, a warty tumor at the orifice of the urethra will occasionally cause intense pain in the region of the bladder and kidney, with a frequent desire to urinate, and excessive scalding in passing water; in short, a train of phenomena closely resembling that produced by vesical calculus.

13. *Uterus.*—There is perhaps no class of sympathies of greater interest, in a pathological and practical point of view, than those which subsist between the uterus and the general system. It was a knowledge of this circumstance which induced Aristotle to say that the womb was an animal within an animal. The morning sickness of early pregnancy, the hysterical convulsions, the depraved appetite, the rigors which usher in labor, and the contraction of the uterus when the cold hand is suddenly applied to the abdomen, are all examples of the mysterious relations by which this organ is bound to the rest of the body. Nowhere do these effects display themselves more strikingly than between the uterus and the mammary gland. During pregnancy, the breasts begin to sympathize at an early period, as is evinced by their tender and tumid condition: and the effect which the application of the child to these organs has, soon after delivery, in causing after-pains, is familiar to every one. A knowledge of this fact has induced obstetric practitioners to take advantage of this means as a remedy for inducing contraction of the uterus in case of tardy expulsion of the placenta, or tendency to hemorrhage of this organ. The derangement of the stomach which accompanies prolapsus of the uterus, the pain and swelling of the mammary gland from menstrual irritation, the suppression of the lacteal secretion in puerperal fever, and the occurrence of carcinomatous disease of the breast at the decline of life, may be cited as additional illustrations of the intimate connection between the womb and the rest of the system.

14. *Testicle.*—An intimate sympathy exists between the testicle and the parotid gland. In mumps, or inflammation of the latter organ, it is by no means uncommon for the testicle, after the lapse of some days, to take on inflammation also, and generally to such an extent as to bear nearly the whole brunt of the disease. The translation of the morbid action is usually quite sudden, and the suffering of the testicle is often much greater than that of the parotid, being not only attended with severe pain and swelling, but occasionally terminating in complete atrophy of the seminiferous tubes. In what manner, or in accordance with what law of the animal economy, this occurrence

takes place, it is impossible to determine, as there is no similarity of texture between these parts, or any direct nervous connection. The parotid is supplied with filaments from the ascending cervical nerves, and with branches from the fifth cranial; the testicle, with filaments from the spermatic plexus, formed by the sympathetic.

15. *Skin.*—Remarkable sympathies exist between the skin and the mucous membrane of the alimentary canal, as well as between the cutaneous tissues and other parts of the body. Irritations, the result of a disturbance of these relationships, are of frequent occurrence, and serve to explain many morbid phenomena which, but for our knowledge of this circumstance, would be a complete mystery to us. The sympathy between the skin and mucous membranes is particularly close and intimate, arising from their great similarity of structure, it being well known that these tissues are convertible the one into the other, although there is no direct connection between them, except at the various mucous outlets; here, however, it is inseparable, and this is perhaps one reason, if not the principal, why disease of the one is so apt to cause disorder of the other. The fact that various substances taken into the stomach as food and medicine often produce the most singular cutaneous affections, within a short time after their introduction, is of daily occurrence. Every one's experience informs him of certain articles which he cannot use with impunity. There is no doubt that many diseases of the skin, generally of a very simple character, are often greatly aggravated and rendered obstinate, by inattention to the diet and neglect of the bowels and secretions; and it will be readily conceded that the practitioner who is aware of all this possesses a great advantage in the cure of these maladies over one who is ignorant of the circumstance, or wilfully disregards it. It is generally supposed that the skin suffers more frequently from disorder of the mucous membranes than the latter do from derangement of the former; but this is probably a mistake. It must not be forgotten that there is a marked difference in respect to the relative frequency of the affections of these two classes of structures in different climates, and at different seasons of the year. In tropical regions the prejudicial effects of a disordered state of the skin show themselves in a great variety of ways in the mucous membranes; especially those of the stomach and bowels, as in different forms of gastric irritation, diarrhœa, and dysentery. Erysipelas, carbuncle, and furuncle are generally supposed, and very correctly, to be essentially connected with disease of the chylopoietic viscera; indeed, the more common varieties of these affections usually owe their origin to derangement of the stomach and bowels, and hence the practitioner rarely makes much progress towards a cure if he loses sight of this pathological relation. An unhealthy state of the skin often produces serious disease of the eye, brain, lungs, and liver, which is promptly relieved by attention to the cutaneous surface. Observation has shown that in bad cases of burns and scalds life is not unfrequently destroyed by ulceration of the duodenum, or the upper portion of the bowel, and yet it would puzzle the most profound physiologist to

account for such an occurrence by a reference to any of the known laws of health and disease.

16. *Eyes.*—It is notorious that the eyes, like all symmetrical organs, have an important sympathy, not only with each other, but also with many other portions of the body, which displays itself both in health and disease, and not unfrequently becomes the subject of irritation and inflammation. A familiar example of this internuncial action occurs in cataract. When one eye suffers from this disease, the other, at no distant period, is very apt to become affected also. Even in ordinary ophthalmia a similar liability to the extension of the morbid action is exceedingly common. The sound eye either soon takes on inflammation, or, if it be so fortunate as to escape this disease, it is sure to become the seat of such an amount of morbid sensibility as to render it utterly unfit, for the time being, for the purposes of useful vision. A percussion cap, or other foreign body, lodged in one eye, has not unfrequently been the cause of destructive inflammation in the other; and this disposition to the involvement of both organs, where one is originally exclusively affected, is nowhere more forcibly and painfully exhibited than in amaurosis. It is true it is not always easy, under these circumstances, to determine, in any given case, what share of the disease in the eye secondarily affected is due to the influence of consentaneous irritation, or to the operation of the same morbific agency which provoked the original malady; but it may reasonably be assumed, in the absence of positive information, that much, in the majority of instances, is the direct result of deranged sympathy. This liability of the eyes to participate in each other's diseases seems to be due to the intimate connection which exists between the optic nerves; and the same circumstance serves to explain the reason why the eyes are so frequently affected in organic disorders of the brain.

The eyes and nose are intimately related with each other, first through the distribution of the ophthalmic branch of the fifth pair of nerves, and secondly through the pituitary membrane, which is prolonged upwards through the lachrymal passages to form the conjunctiva. Hence it is easy to see how catarrhal affections should induce pain and redness in this membrane as it is reflected over the eyes; how snuff should excite a flow of tears; and how sudden exposure of the eyes to a strong light should cause sneezing. The connections which the frontal, infra-orbitary, and other nerves form with the filaments of the ophthalmic ganglion enable us to explain the occurrence of amaurosis in consequence of blows, wounds, and neuralgia of the face, eyebrows, forehead, and temples.

The eyes are connected with the abdominal viscera, particularly the stomach and bowels, through the medium of the branches of the sixth pair with the great sympathetic. The partial blindness, consequent upon gastro-enteric irritation, is readily accounted for in this way; and the same circumstance serves to explain the dilated state of the pupil which occasionally attends the presence of worms in the alimentary canal of children. It is probable that the pneumogastric nerves also play an important part in these sympathetic relations,

otherwise it would be difficult to assign a reason for the excessive nausea and vomiting which now and then supervene upon injuries and operations of the eye, as severe blows and the depression of the cataract.

The eyes and teeth sometimes actively sympathize with each other, caries of the latter occasionally keeping up violent inflammation of the former, which promptly disappears upon the removal of the offending organ. I have several times seen the photophobia attendant upon strumous ophthalmia, speedily yield in this way, after the failure of numerous other remedies.

17. *Age and Effects.*—All persons are liable to suffer from irritation; but there is, as might be supposed, great diversity in this respect, in different individuals. Thus, it is well known that persons of a nervous, irritable temperament are more prone to be affected with it than such as are of a sanguine or leucophlegmatic disposition, owing no doubt to the fact that they possess a more highly-wrought nervous system. Women suffer more frequently than men, both from local and general irritation; and some of the worst forms of reflex irritation that the practitioner meets with occur in hysterical females. Infants and children are extremely liable to the disease, the slightest cause often serving to light up the most distressing suffering. Loss of sleep, anxiety, grief, hard study, intemperance, inordinate sexual indulgence, impoverished diet, and the enervating effects of a hot climate, are all circumstances which powerfully predispose to the occurrence of irritation. The inhalation of the foul air of the dissecting-room is another well-known cause operating injuriously upon the system. If a young man who is nightly engaged, until a late hour, in the study of practical anatomy pricks his finger, he will be much more likely to suffer severely than one from a similar wound who enters the dissecting-room only occasionally. In the one case the constitution is deteriorated by exposure, and is therefore incapable of resisting the effects of disease; in the other, on the contrary, it is healthy, and indisposed to take on morbid action.

An irritable state of the system often sadly interferes with the reparative process. Thus, the healing of a wound is sometimes suddenly arrested by an unhealthy state of the system, manifesting itself in a general exaltation of the nervous sensibility, altogether incompatible with the development of healthy blastema. An aneurism of the aorta, attended with constitutional irritability, has been known to prevent the consolidation of a fracture of the femur. These, and other similar facts are of deep practical interest, as they are suggestive of valuable therapeutic measures.

Another very common effect of irritation, especially when extensive, or seated in an important organ, is derangement of the secretions, not only of the parts more immediately affected, but of the rest of the system. Thus, irritation of the brain, however induced, is very certain to disorder the functions of the stomach, liver, and kidneys, as evinced by indigestion, a bilious appearance of the skin, and a high-colored and

scanty state of the urine. The salivary glands, too, suffer, the mouth becoming dry and viscid; the head aches, the pulse is excited, and the extremities are cold.

In concluding this rapid survey of irritation and sympathy, a few remarks may be offered on the subject of idiosyncrasy, as it closely connects itself with the discussion of these two topics.

Idiosyncrasy literally signifies a peculiarity of constitution, or a state of the general system in which certain articles, whether taken as food, drink, or medicine, produce an effect altogether different from what they are accustomed to under ordinary circumstances. Thus, lobster and other varieties of shell-fish, although they may be used with perfect impunity by most persons, are extremely prone in some individuals to induce urticaria, vomiting, and purging. Some persons are overpowered by a particular odor, or by the sight of blood. I know a lady who has not been able, for many years, to eat watermelon without being almost immediately seized with hoarseness and soreness of the throat and mouth, attended with a burning, pricking sensation, nausea, and colicky pains. The use of watermelon-seed tea invariably produces a similar effect. Another lady, formerly a patient of mine, can never take an ordinary dose of laudanum without being copiously purged; opium affects her in a similar manner, but morphia does not. Laudanum, administered by the rectum, vomits freely and nauseates for many hours. These articles, however, always afford relief to her suffering. I am acquainted with several persons, among others a physician, in whom the inhalation or smell of ipecacuanha invariably excites a violent attack of asthma, generally lasting for two or three days. In the case of the medical practitioner, the perception of the presence of this substance is so keen that, if he be in the third story of a house on the first floor of which an ordinary dose of the article is compounded, he is instantly seized with spasmodic cough and wheezing. A gentleman, for many years a patient of mine, cannot drink a cup of green tea without being promptly and copiously purged by it; it usually operates on the bowels in from fifteen to twenty minutes after it is taken, bringing away thin, watery evacuations, accompanied with more or less griping; black tea produces no such effect, which he has experienced from the green from his earliest recollection.

I remember the case of a patient, an habitual asthmatic, thirty-five years of age, a tradesman by occupation, who cannot enter a room where feathers are without instantly experiencing an aggravation of his pulmonary affection. To provoke this effect, it is not necessary that he should see or smell the feathers; it is only necessary that they shall be near him. Led blindfold into an apartment thus furnished, he will at once be conscious of their presence, and be immediately compelled to retreat.

Idiosyncrasy not unfrequently displays itself in the operation of various medicines, affording thus useful hints to the practitioner in the selection of his remedies. There are many persons who cannot take opium in any form without being kept awake by it for hours and

even days, besides suffering greatly from nausea, excessive itching, delirium, and other distressing symptoms. The most minute quantity of mercury will, in some persons, cause profuse ptyalism, while in others the article may be given in large doses and for a long time without the slightest effect of this kind, the system being absolutely proof against the action of the medicine in any of its forms and modes of exhibition. Most individuals are freely purged by a drop of croton oil, and yet we occasionally meet with an instance in which hardly any operation upon the bowels is produced by twenty times that quantity.

The above instances, which might be multiplied to an almost indefinite extent from my own experience, will serve to illustrate a class of the most singular affections, whose influence in modifying, if not in inducing disease, is eminently worthy of the attention of the practitioner.

TREATMENT.

In the treatment of irritation there are several leading facts which claim special attention. The first is to remove the exciting cause; the second, to correct the secretions; and the third to palliate the disease, both primary and consecutive.

To remove the exciting cause of irritation is not always an easy task. In many cases, indeed, it is either wholly inappreciable, or can only be guessed at. The duty of the surgeon of course plainly is to get rid of it if he can; the ball, the calculus, the splinter of wood, the dead piece of bone, and the carious tooth, are promptly extracted. Irritating ingesta are dislodged by emetics; offending feces by purgatives; worms by anthelmintics. The mortified toe is amputated; the compressed gum lanced; the suppurating felon freely laid open. Light is excluded from the inflamed eye; noise from the suffering ear; cold from the shivering surface. In all such cases the indication is plain, and in general easily fulfilled. But it is otherwise when the cause is occult. Here the disease must be met on general principles; and the judicious practitioner will do well to look into the condition of his patient's secretions, his bowels, and his diet, which are among the most common sources of the disease.

The correction of the secretions is a matter of primary importance in every case of irritation, whether local or constitutional. The manner of doing this will necessarily depend upon the character of the suffering organ; but no practitioner will fully discharge his duty if he neglect attention to this point. The viscera whose derangements are most liable to provoke reflex irritation are the stomach, bowels, liver, and uterus, and they should, therefore, always be objects of special consideration. Not unfrequently the cause of the trouble will be found to exist in spinal irritation, or in some particular portion of the brain, demanding local depletion and counter-irritation, with perfect tranquillity of mind and body. Whatever the cause of the disturbance may be, it will be found that purgatives can rarely be dispensed with, while in not a few cases they constitute the chief

anchor of our hopes. The diet, as a general rule, should be mild and unirritant, the proportions of its nutritive principles varying with the exigencies of each particular case.

The last indication is to palliate, or cure the disease. To point out the methods of doing this in a class of affections of so protean a character as this, would be absurd. Every case must necessarily suggest its own treatment. In ordinary cases antiphlogistics, properly so called, may usually be dispensed with, and large draughts made upon the narcotic class of remedial agents, as their direct influence is to allay pain and spasm, and induce tranquillity of the system. The choice of the particular articles must be regulated by the circumstances of the case, and will often require no little judgment and experience for its successful exercise.

CHAPTER II.

CONGESTION.

It is practically a matter of no little importance that the surgeon should be able to discriminate accurately between inflammation and congestion; or, in other and more comprehensive terms, that he should possess clear and definite ideas respecting the more essential differences between these two morbid states; for upon their correct appreciation must often depend the result of his treatment. The subject, it must be confessed, is one of no ordinary difficulty, and a careful examination of what has been written upon it will serve to convince any unprejudiced mind that there are no two points in pathology concerning which there still prevails a greater amount of confusion; for what one author considers as congestion, another with equal confidence calls inflammation, and conversely; leaving thus the young and inexperienced practitioner in painful doubt not only in respect to the nature of the disease, but, what is far worse, in regard to its proper mode of management. As the subject of inflammation will be fully discussed in the ensuing chapter, I shall limit myself here to a plain and simple exposition of some of the more important facts relative to congestion, preceded by an attempt to assign to this expression its legitimate import.

Congestion signifies an accumulation of blood in a part, the result either of some mechanical obstruction, or of some vital defect in the circulation, interfering with the onward movement of the sanguineous fluid. The word is synonymous with hyperæmia, which Andral has proposed, without any just reason, as a substitute for it. It simply denotes the existence of an abnormal quantity of blood in a part, without any of the ordinary phenomena and effects of inflammation, which, however, it generally accompanies, if indeed it does not form a necessary consequence of the increased quantity of blood sent into the suffering structures in that disease. Pathologists usually divide congestion into two varieties, denominated, respectively, the active and the passive. The first, as the name implies, is characterized by inordinate activity of the part, as is evinced by its scarlet complexion, its augmented temperature, and its functional disturbance; and soon leads, if allowed to progress, to various kinds of deposits, particularly the serous and plastic. Passive congestion, on the other hand, is distinguished by the dark color of the part, the enlarged and sluggish condition of the vessels, and the chronic march of the disease. Owing to these differences in the action and aspect of the affected structures, these two varieties of congestion are often denominated arterial and

venous; terms which are ill chosen, as they have a tendency to create erroneous impressions respecting the true nature of the two lesions, for it is impossible to conceive of any case of congestion, however slight or severe, in which the disease is exclusively confined to one set of vessels.

It will thus be perceived that *active congestion* is closely allied to inflammation, although it does not, properly speaking, constitute inflammation, except in the opinion of certain pathologists, who, as it seems to me, are not very felicitous in their attempts at separating the two affections from each other, although it is evident that they strive very hard to do so. They treat of congestion as a distinct entity, and yet they do not hesitate to ascribe to it phenomena and effects which belong exclusively to inflammation, and which congestion, considered in the proper sense of that term, is utterly incapable of producing. Whenever a part, however situated in relation to the amount of blood it contains, is the seat of morbid deposits, it has passed the stage of congestion, and gone over into that of inflammation. If this be not so, then it necessarily follows that active congestion and inflammation are essentially one and the same disease, and that, consequently, it is absurd to attempt to describe them separately.

In all acute inflammations, whatever their cause or situation, active congestion is a necessary antecedent of the morbid action; one of the first links in the chain of the malady. Hence it would not be improper to say that it is part and parcel of the inflammatory process, ushering in the disease, and continuing up to the very point of effusion; or, in other words, ceasing only where effusion commences. But this is strictly true only to a certain extent; for there is in every case of inflammation a circle beyond the process of the morbid action, where the blood, playing about in eddies, has accumulated in large quantity, distending the capillaries, and destined soon to part with some of its constituents, if the disease be merged in the inflammation. A real fire is lighted up here; the part is hot, preternaturally red, and perhaps somewhat painful; nay, it may be, even a little tumid, from the dilated state of the vessels; the blood moves with unwonted force and velocity; the functional disturbance augments more and more; and presently congestion ceasing, inflammation takes its place, and goes through its allotted course. Another sign of distinction is that, in active congestion, the capillaries, although greatly crowded with blood, are more easily emptied than in inflammation: during life by pressure, and after death by injecting matter.

But active congestion is not always necessarily followed by inflammation, although prone to pass into that state if it continue even for a short time. The cause which induced it having been removed, the vessels cease to attract blood in undue quantity, and getting rid of what is redundant, speedily regain their normal caliber and function. A familiar illustration of this occurrence is afforded by the conjunctiva, when, from any transient cause, a sudden and violent rush of blood takes place to the affected part; in an instant hundreds of vessels, previously invisible, become apparent, being crowded with red blood, so as to give the surface almost a scarlet hue. Now, if we analyze these

phenomena, it will be found that they depend simply upon a dilated state of the vessels of the eye and the presence of an unusual quantity of blood, containing a large number of red globules, which, in the healthy state, are either withheld from these vessels, or which are propelled along them in such small numbers as not to permit their coloring matter to become visible through their delicate walls.

Another familiar example of active congestion is furnished by what occurs in the hand when plunged into cold water, or exposed to a very low temperature. The skin soon becomes remarkably red from an unnatural afflux of blood, the parts are the seat of an unpleasant tingling sensation, and the capillaries, both arterial and venous, are exceedingly dilated; still, there is no inflammation, or any tendency to morbid deposit; the suffering structures are only irritated and preternaturally injected. Cautiously treated, the hand soon regains its natural condition; the skin recovers its former hue and sensibility, the blood ceases to accumulate, and the vessels resume their normal caliber. But it is otherwise, when the case is improperly managed; the congestion then will not only continue but it will steadily increase, and be soon merged in inflammation, or perverted action and effusion.

Now what occurs in the external parts of the body, immediately under the eye of the observer, may be supposed to happen, under similar circumstances, in the internal organs. Thus, we know that when there is a sudden repulsion of the cutaneous perspiration, the blood is extremely apt to collect in the lungs, causing active congestion of the pulmonary tissues, so often the precursor of pneumonia. Poison introduced into the stomach almost instantly induces active congestion of the mucous membrane of that organ, frequently followed, in a few hours, by the most intense and destructive inflammation. A ligature bound tightly around a limb affords a good illustration of the manner in which active congestion may be supposed to be induced in strangulation of the bowel in hernia and in intussusception.

A distinction should be made between active congestion in a part, and a determination of blood to a part. The former is always the effect of some morbific influence; the latter, on the contrary, may be the result simply of a natural cause. Thus, when the infant is applied to the breast there is an instantaneous determination of blood to the organ, so as to enable the vessels to furnish the necessary supply of milk; during menstruation, there is a marked determination of blood to the uterus, probably accompanied with more or less active congestion. In blushing there is a rush of blood to the cheek; in erection, to the penis; in anger, joy, and other emotions, to the brain. Excessive, sudden, and overwhelming determination of blood to the internal organs sometimes takes place during the cold stage of intermittent fever, especially in that variety of it to which Alibert and others have applied the term malignant. In the congestive fever, as it is termed, of the Southern States, death not unfrequently results within a few hours after the commencement of the attack, the system never reacting from the effects of the chill. Scarlet fever occasionally proves fatal in a similar manner; the surface is pale, or slightly livid, the extremities are deadly cold, and the internal organs are literally

inundated with blood, determination and congestion co-existing in their worst forms.

In *passive congestion*, the morbid action is distinguished by its peculiarly sluggish character; the vessels are not only dilated, but frequently varicose, tortuous, elongated, and incapable of contracting upon their crowding contents; the discoloration is dark, venous, or purple, the circulation is tardy and languid, and there is often marked evidence of morbid deposits, especially of serum and lymph, occupying the cells of the areolar tissue.

Various causes may give rise to passive congestion. The most common are the following: 1st, inflammation; 2dly, mechanical obstruction; 3dly, debility; and 4thly, dependent position.

1st. Inflammation, in whatever form occurring, is almost always followed by a certain degree of passive congestion; the affected parts, exhausted by severe suffering, are reduced in strength and life-power; the vessels, dilated to their utmost capacity, and perhaps partially ruptured, are too feeble to contract upon their contents; the crippled structures are unusually vascular; and the slightest cause is generally sufficient to rekindle the disease. Indeed, as will be stated by and by, an organ that has been once severely inflamed is ever after extremely liable to become inflamed again; passive congestion often lasting for months and even years.

2dly. Mechanical obstruction is a prolific source of passive congestion. Examples occur almost without number, both in medical and surgical practice. I shall allude only to a few, as they will be sufficient for my purpose.

A good illustration of the effects of mechanical obstruction in producing passive congestion is seen in organic disease of the valves of the aorta, impeding the passage of the blood through the lungs. Compelled to remain here habitually in undue quantity, the pulmonary vessels soon fall into a state of passive congestion, which thus acts as a predisposing cause not only of inflammation, to which individuals so affected are extremely prone, but also of pulmonary apoplexy. Obstruction of the larger veins, as the femoral and iliac, is always followed by passive congestion in the parts below. In varicose enlargement of the veins of the leg, attended with disease of their valves, the blood has great difficulty in finding its way to the heart, and the consequence is that the distal portion of the limb is always in a state of passive congestion, with a strong tendency to inflammation, and different deposits, especially the serous and plastic. Obstruction of the artery of the leg, by fibrinous concretions, is always followed by congestion and inflammation, if not gangrene of the foot.

The structures in the neighborhood of morbid growths are generally habitually congested; hence the profuse hemorrhage which so often attends their extirpation. Their vessels being compressed by the overlapping tumor, the passage of their contents is seriously interfered with, and hence they frequently undergo a remarkable dilatation, almost amounting to a real varicosity.

3dly. Debility of a part, however induced, is a frequent source of passive congestion. Examples of this form of the affection are seen

in the retina and choroid coat of the eye from over-exertion of that organ; and in various parts of the body from loss of innervation, profuse hemorrhage, or other discharges, and from the natural wear and tear of the frame. If, under these circumstances, any particular organ is more feeble or exhausted than the rest, it can scarcely fail to become the seat of passive congestion, or congestion and inflammation.

4thly. That dependent position may give rise to passive congestion is a matter of daily observation. It is in this way that inflammation of the lungs is so often induced during the progress of lingering diseases and accidents, as typhoid fever, erysipelas, and compound fractures; the disease usually beginning in the posterior portions of these organs, in the form of passive congestion, and proceeding gradually but steadily from bad to worse, until it proves fatal, a result so much the more to be dreaded on account of its insidious character. In the so-called bedsores, consequent upon long confinement in one posture, during which the pressure of the body is concentrated with peculiar force upon the sacrum, the iliac crest, and the great trochanter, similar effects are produced. There is, both in these and similar instances, in the first place a determination of blood to the most dependent portions of the body, then passive congestion, and, finally, as a natural consequence, inflammation; often followed, in the latter case, by mortification.

Passive congestion, however induced, is a frequent cause of inflammation; often of a very destructive character, the more so, because the symptoms which attend it are so indistinct, if not so completely disguised, as to prevent the early recognition of their real import. It is for these reasons that the practitioner should constantly be on the alert whenever he has anything to do with diseases and injuries involving long confinement to one particular posture, and an unusual amount of expenditure of the vital forces.

Inasmuch as congestion may be induced by such a variety of causes, it would be folly to attempt to lay down anything like a regular systematic plan of treatment; to do so, would be to encroach upon every department of pathology and practice, both medical and surgical, of which we have any knowledge. The judicious surgeon, knowing how likely the continuance of such a condition is to be followed by inflammation, or to aggravate inflammation when these two states coexist, will do all in his power to avert the evil, or to combat it when he finds that it has already taken place. The leading indication of cure, in every case of congestion, is to equalize the circulation; but to accomplish this object often demands great judgment and an amount of pathological and therapeutic knowledge such as comparatively few men possess.

CHAPTER III.

INFLAMMATION.

SECT. I.—GENERAL CONSIDERATIONS.

A THOROUGH knowledge of inflammation is indispensable to every practitioner of surgery. It should form the principal subject of his studies during his pupilage, and the main object of his professional contemplation in after life. When it is recollected that there is hardly any disease which comes within the province of this department of science that does not originate in inflammation, or that is not more or less affected by it during its progress, the truth and force of these remarks will appear sufficiently obvious. The smallest pimple upon the nose is, in point of fact, as much an inflammation as an erysipelas that covers the face and head. An ulcer of one of the mucous follicles of the mouth does not differ, in principle, from an ulcer of one of the glands of Peyer, which are the seat of so much disease and danger in typhoid fever. Many of the maladies, vaguely called nervous, are nothing but forms of inflammation, the nature and seat of which it is often difficult, and frequently impossible, to determine. Their predominant symptoms are of a nervous character, and hence the diseases which they accompany are usually considered as nervous, while in reality the reverse is too often the case.

All accidents, whatever may be their nature or degree, are necessarily followed, if the patient survive their immediate effects, by inflammation. The little wound made in venesection, the incision left in cupping, and the bite inflicted in leeching, would never heal without the aid of this process; the parts would remain open, and be the seat of incessant bleeding, or they would become festering and putrid sores. In a word, there would be no reparation after injuries of any kind, however simple, and operative surgery, instead of bearing healing on its wings, and being a blessing to our race, would be the merest cold-blooded butchery. Thus, it will be perceived that inflammation is capable of playing, as it were, a double game in the animal economy, being at one time a cause of death, and at another a source of life. It is for this reason that it is often designated by the terms healthy and unhealthy, according as the one or the other of these states predominates.

Inflammation may be defined to be a perverted action of the capillary vessels of a part, attended with discoloration, pain, heat, swelling, and disordered function, with a tendency to effusion, deposits, or new

products. In addition to these changes, there is also an altered condition of the blood and nervous fluid as an important element of the morbid process. In what inflammation essentially consists, it would be idle to inquire, since it would be just as impossible to unravel its true nature as it would be to explain the intimate character of attraction, repulsion, gravitation, or cohesion. Hence, in studying its history, all that we can do is to examine its causes, symptoms, and effects, or, more properly speaking, to institute a rigid analysis of its appreciable phenomena. If we endeavor to step beyond this, we shall, like our predecessors, lose ourselves in the mazes of conjecture and hypothesis, those quicksands upon which so many of the noblest minds of the profession have, in all ages, since the origin of medicine and surgery, been wrecked and stranded, as if to warn us of their folly and the impossibility of further progress.

1. CAUSES OF INFLAMMATION.

The causes of inflammation are almost as numerous as the circumstances which surround us. Whatever has a tendency to affect injuriously our mental or physical organization, whether directly or indirectly, is capable of inducing disease, or, at all events, of laying a foundation for it. The division of the causes of morbid action into predisposing and exciting has long been recognized by pathologists, and cannot be dispensed with at the present day. By predisposing causes are understood those which produce in the system, or in a particular part of the economy, certain changes, states, or conditions favorable to the development of inflammation, without actually provoking it. They are usually tardy in their operation, and are either natural or acquired, according as they are inherent in the constitution of the individual or dependent upon accidental circumstances. The exciting causes, on the contrary, are such as are directly concerned in awakening the disease, or fanning it, as it were, into existence. It is not always, however, in the power of the practitioner to ascertain either the predisposing or exciting causes of the morbid action, and hence such cases, which are by no means unfrequent, are usually known as occult cases.

The natural *predisposing causes* of disease have reference to peculiarities of constitution, and to a tainted state of the economy, in consequence of hereditary transmission. To the former class belong plethora, debility, and nervous susceptibility, which prepare the system for disease, by the changes which they produce both in the fluids and solids. Persons who have naturally an undue quantity of blood, as indicated by their ruddy complexion, and the extraordinary functional activity of their organs, are peculiarly prone to inflammation; their bodies may be compared to a mass of tinder, which the slightest spark is capable of kindling into a devouring flame. Those, on the other hand, who are naturally feeble, are remarkably prone to local congestions, which, especially when they become habitual, are sure to lead to inflammation, often of a very unmanageable character, because it cannot be met by the ordinary remedies. Persons of nervous tem-

perament are predisposed to maladies of the brain, spinal cord, and sympathetic nerves, as exhibited in derangement of the respiratory, digestive, and genito-urinary apparatus; maladies which are generally tardy in their progress, and which are often so obscurely marked as to be difficult of recognition.

The fact that some diseases are transmissible from the parent to the offspring has long been known to practitioners. There are family diseases, just as there are family likenesses, manners, and peculiarities; and, what is remarkable, they are more liable to be communicated by the mother than the father, as if it were her special prerogative to impress her vices, as well as her virtues, upon her descendants. Another law is that some of these diseases may skip one generation to reappear in another, and that it is not necessary that the parents should be actually laboring under an attack of them at the period of the child's conception. The affections which may be transmitted in this way are gout and rheumatism, pulmonary phthisis, asthma, scrofula, carcinoma, and constitutional syphilis, together with several others which it is unnecessary here to specify. It is in this wise apparently that God visits the sins of the parents to the third and fourth generation of their offspring. In what element of the economy the germ of the morbid action is locked up, neither reason nor experience has been able to determine: for a time it would seem to be latent in the blood, and then to explode, either suddenly or gradually, with zymotic violence.

Among the acquired predisposing causes of inflammation are, the effects of previous disease, plethora, and debility, however induced. When an organ has once labored under inflammation, it is extremely apt to suffer from it again from the most trifling causes. The part, enfeebled by the attack, does not recover completely from its effects for a long time, if ever. Hence, influences which, in the natural state, would not disturb its physiological relations, are, under such circumstances, peculiarly prone to excite disease. A good illustration of this fact is afforded in the tonsillitis of children, in whom a reproduction of the malady is almost sure to be awakened upon the slightest exposure to cold. It is not necessary here to enlarge upon plethora and debility as predisposing causes of inflammation. If these states of the system are capable of preparing it for the development of disease when they are a natural result of the organization, it may readily be supposed that they would be much more likely to produce such an effect when they are acquired, in consequence of the mode of life of the individual, or of the influence of structural lesion.

Age, sex, temperament, occupation, food, dress, exercise, climate, and season, are all so many predisposing causes of inflammation. Infancy is particularly obnoxious to enteritis, croup, and arachnitis; childhood, to affections of the skin, struma, parotitis, and tonsillitis; manhood, to pneumonitis, carditis, and diseases of the genito-urinary organs; and the decline of life, to gout and rheumatism, asthma, arteritis, and the various forms of malignant maladies.

The differences in regard to the liability of inflammation in the two *sexes* arises mainly from their anatomical peculiarities, and are much

less common than is generally imagined. The function of parturition renders the female particularly liable to peritonitis, phlebitis, arachnitis, and carcinoma; while the male, from his occupation and mode of life, is more prone to cystitis, urethritis, gout, rheumatism, arteritis, hepatitis, pneumonitis, and pleuritis.

Of the influence of *temperament* as a predisposing cause of disease, too little is known to enable us to speak with any degree of certainty. The sanguine temperament being characterized by plethora with inordinate capillary activity, disposes to inflammation of the internal organs; while the lymphatic is apt to be attended with affections of the skin, joints, serous membranes, stomach, bowels, and lymphatic ganglions.

Occupation is a powerful predisposing cause of inflammation. Persons who work much in the open air, and who are much subjected to the influence of cold and wet, are extremely liable to suffer from pneumonia, arthritis, tonsillitis, and enteritis. A sedentary life leads to chronic disorder of the alimentary canal; and, if conjoined with constant mental exertion, is liable to be followed by diseases of the brain and arachnoid membrane. Excessive exercise of an organ, as of the larynx in singing and speaking, is always a predisposing cause of inflammation.

The influence of *food* in disposing to inflammation is well known. The habitual use of stimulating articles of diet, especially when conjoined with a want of due exercise, is among the most powerful of the causes under notice. On the other hand, an impoverished diet, by inducing a defective blood, leads to scurvy, chlorosis, typhoid fever, scrofula, and inflammation of the serous structures, terminating in dropsical effusions. Certain articles, as ergot, if employed for any length of time, or in any considerable quantity, dispose to arteritis and gangrene of the extremities. The habitual indulgence in alcoholic drinks leads to gastro-enteritis, hepatitis, and attacks of epidemic diseases, whenever such diseases are prevalent.

Dress may be an indirect cause of inflammation. It may keep the body too warm or too cold, or exert injurious compression; in either event, local congestion will be apt to be induced, which the slightest circumstances may fan into disease.

A change of *climate*, whether from hot to cold, or cold to hot, powerfully predisposes to inflammation. Hence the period of acclimation is always peculiarly trying, and few persons escape without suffering. Season, too, exerts a predisposing influence. Thus, in summer, inflammation is most apt to assail the stomach and bowels; in winter, the lungs, pleura, joints, and throat.

Mental excitement is a prolific source of inflammation. Fear, grief, anxiety, hard study, and loss of sleep, by deranging the secretions, and interfering with the digestive process, all dispose to this disease. In short, whatever has a tendency to interrupt, disorder, or arrest healthy action, is apt to exert a pernicious influence. This is often the only way in which we can account for the occurrence of erysipelas, carbuncle, rheumatism, cerebritis, scrofula, and carcinoma.

The *exciting causes* of inflammation are extremely numerous, and of

the most diversified nature; they act in two ways, either directly upon the parts, or indirectly through the system. Hence they are said to be local and constitutional; and the former are either of a chemical or mechanical character.

Among the *chemical* causes are, first, high degrees of heat, as hot water and iron; secondly, partial application of cold; thirdly, caustic substances, as the alkalies and acids; fourthly, acrid vapors, harts-horn, and gases; fifthly, certain secretions, as urine and bile; sixthly, blisters, embrocations, and rubefacients; and lastly, various septic agents, as those of smallpox, syphilis, glanders, and malignant pustule. All these agents act directly upon the parts to which they are applied, either destroying them by their immediate effects, or combining with them in such a manner as to change completely their structure and function. Their operation is always rapid, and the resulting inflammation is usually marked by severe symptoms, both local and constitutional.

The *mechanical* causes comprise, first, punctures, incisions, contusions, and lacerations; secondly, fractures, and dislocations; thirdly, sudden and forcible distensions, as from the accumulation of pus, serum, blood, or gas; fourthly, compression, as by bandage, ligature, posture, or effused fluids; and, fifthly, the presence of foreign bodies, as a stone in the bladder, a bean in the air-passages, or a bullet in the flesh. The manner in which these various causes act in producing inflammation is too evident to require explanation.

The *constitutional* causes of inflammation make their impression either directly upon the part, or indirectly through some remote structure. Logically speaking, it would perhaps be more proper to say that they all act in the latter way, and not in any case immediately upon the part, as is usually asserted they do. Thus, a morbific impression primarily made upon the respiratory passages, as the inhalation of some noxious gas, or the contact of malaria, instead of causing disease in the lungs, or some of its constituents, often, if not generally, explodes upon some other organ, perhaps very distantly, if at all, associated with the lungs by sympathy, or similarity of structure and function. A septic poison, for example, as the virus of smallpox, introduced into the system, acts not merely upon the blood into which it has been conveyed by the absorbent vessels, but also, and mainly, upon the cutaneous tissues, for which it has evidently a greater elective affinity than for any other part of the economy; if it produces any action at all upon other structures, it is altogether of an indirect character. In the transmission of secondary syphilis from the parent to the offspring, the force of the disease is spent, in the first instance, upon the skin and mucous membrane of the throat and mouth; there is no inflammation, so far as we are able to determine, in the cellular, fibrous, and serous tissues, or in the internal organs, properly so called. In tertiary syphilis the bones, periosteum, and cartilages are particularly prone to suffer, although the disorder has a more general tendency, as there is more profound contamination of the system.

Whatever doubt, however, there may still be respecting the mode

of action of the above agents, there can be none about the operation of heat and cold, which are such prolific causes of inflammation. The influence of a tropical sun, acting upon an impressible nervous system, in producing hepatitis, is well known to the practitioners of our Southern States, and to those of Africa, Asia, and the West Indies. Gastritis and enteritis, in their worst forms, are often developed in the same manner. The effect of cold feet in producing tonsillitis, croup, pleurisy, pneumonia, enteritis, cystitis, and rheumatism, is familiar to every one. In all these instances the primary impression is made through the medium of the skin, by suppressing the perspiration, and throwing the onus of the functional disorder upon some internal and remote organ, between which and the cutaneous surface there is not the least direct connection.

The blood itself is a frequent source of inflammation; sometimes, because it is overloaded with earthy salts or other irritating materials, as the poison of erysipelas, carbuncle, and various eruptive diseases; at other times, because of its impoverished condition, rendering it unfit as a supporter of life and nutrition. There is reason to believe that the latter cause lies at the foundation of many of those low and unhealthy forms of inflammation which so often eventuate in destructive ulceration of the mucous and cutaneous tissues, as well as of some of the worst forms of morbid deposits, as imperfectly vitalized lymph, albumen, and tubercle. Deficient secretion, especially of the liver, kidneys, and skin, is a frequent cause of disease, various substances being thus retained in the circulation, much to the detriment of the general economy, as well as of particular organs, perhaps already predisposed to morbid action.

From the foregoing considerations it will be perceived that inflammation may be *traumatic* or *idiopathic;* that is, produced by external injury or constitutional causes, the latter of which are often wholly inappreciable by our senses.

Inflammation is sometimes caused by *sympathy*. Thus, the eye occasionally suffers in consequence of disorder of the stomach, the brain of derangement of the intestines, the mamma of disease of the uterus, and the testicle of lesion of the urethra. A man who has for years habitually overtaxed his digestive powers, and in the meanwhile taken hardly any exercise, will be extremely apt, in time, to perish from carbuncle or erysipelas; or, at all events, to have disease, in some form or other, of the skin, simply because these parts are intimately related to one another by similarity of structure and function. For the same reason disease of the skin is very liable to be followed by disorder of the alimentary canal.

Finally, inflammation may be caused by *metastasis*. The event is characterized by a transfer, for the most part gradual, but occasionally quite sudden, of irritation from the part originally affected to another, perhaps at a considerable distance from it, and in nowise related to it by structure or function. In inflammation of the parotid gland the testis is often involved in this way, but why it should be, neither our anatomical nor our physiological knowledge enables us to explain, as there is no traceable connection of any kind whatever between

them. In rheumatism of the joints the heart often suffers; and in erysipelas of the skin the morbid action frequently leaves one part of the surface and breaks out upon another. Such occurrences, which are sometimes greatly promoted by our local applications, should always be sedulously watched, as they are generally fraught with danger, especially when they show themselves in important internal structures.

2. EXTENSION OF INFLAMMATION.

The manner in which inflammation spreads, or extends from one structure to another, is worthy of brief notice. This may happen in several ways, as by continuity of structure, through the agency of the vessels, by nervous sympathy, and probably also through the aid of the blood, which, as will be seen hereafter, is always more or less disordered in the more severe forms of the malady, however situated.

All inflammations, whatever may be their character, are, in the first instance, of a local nature, that is, they begin in, and are confined to a particular tissue, spot, or point, from which, as from a common focus, the morbid action radiates in different directions, until it becomes, so to speak, general. To illustrate my meaning, let it be supposed that the malady commences in a particular part of the mucous coat of the small bowel, as, for example, in one of the glands of Peyer. After having remained here for a short time, it gradually spreads to the fibro-cellular lamella, then to the muscular fibres, and finally to the peritoneal investment, thus involving the whole in one mass of disease. In erysipelas the same law is observed. Here the morbid action, beginning at a little point of skin, gradually extends to the deeper structures, until, as in the case of a limb, it invades cellular substance, aponeurosis, muscle, vessels, nerves, periosteum, and occasionally even bone. A pneumonia, in its progress, usually involves the pulmonary pleura and the bronchial mucous membrane. These instances will suffice to prove the position here assumed, which is the more important because it presents the characters of a general principle.

The rapidity with which inflammation extends from one texture to another is too variable to admit of any precise statement; in some instances the time is very short, perhaps not exceeding a few hours, and such cases are, it may be remarked, generally very prone to be characterized by more than usual violence. It must not, however, be inferred from this statement that the morbid action always spreads from the point originally attacked; for, although there is unquestionably always a very strong tendency to this, yet there are numerous exceptions to it. In some cases this limitation is due to the nature of the disease itself; in others, it depends upon the deposit of plastic matter; while in a third series of cases it is owing to the structure of the overlying tissue, as, for example, in the periosteum, which often serves to protect the bone which it surrounds from the encroachment of disease of the soft parts.

One of the most common modes in which inflammation propagates

itself is by *continuity* of *structure*. The morbid action, once begun, finds it easy to pass along the tissues in which it originated, and hence it often spreads rapidly over a large extent of surface, similarity of structure and function favoring the process. By continuity of surface an erysipelas of the skin, perhaps not larger at its commencement than half a dime, spreads in a few hours over an entire limb, or even over the greater portion of the body. In the same manner inflammation is liable to be propagated along the mucous canals, as is exemplified in tonsillitis, croup, and other affections of the throat and air-passages, and in the various diseases of the stomach, bowels, and genito-urinary apparatus. In duodenitis the morbid action may readily extend along the choledoch and hepatic ducts to the liver; and in gonorrhœa nothing is more common than for the disease to spread along the seminal passages to the epididymis and testis.

In the second place, inflammation may propagate itself by *contiguity* of *structure*, as already indicated in one of the preceding paragraphs. A phlegmonous erysipelas of the skin has a tendency not merely to spread over the neighboring surface, in consequence of its similarity of structure and function, but also to extend in depth, thereby involving cellular tissue, aponeurosis, muscle, and, in short, every other texture within its reach. The tissues mainly concerned in the enterprise are the vascular and connective, the peculiar structure of which renders them highly favorable for the propagation of the morbid action. An inflammation, beginning in the conjunctiva, often in its progress involves the entire eye, simply from the intimate manner in which its different tunics are superimposed upon each other. In the bowel and other mucous canals the same effect is frequently witnessed. In pneumonia, especially in the more violent forms, the disease is rarely confined to the parenchymatous substance, but is almost sure, in time, to spread to the pleura and bronchia. In orchitis, although the inflammation is primarily seated in the tubular structure of the epididymis and testicle, yet it is by no means uncommon for it to extend to the albugineous coat, and occasionally even to the vaginal. An inflammation of the synovial membrane of a joint often extends, by virtue of the same law, to the articular cartilage and the head of the bone beneath, contiguity and intimate connection favoring here, as elsewhere, the propagation of morbid action.

Thirdly, the extension may be effected through the agency of the *veins* and *lymphatics*. Of the former a good example is afforded by what occasionally happens in venesection, where, apparently from the use of a foul lancet, the inflammation is sometimes spread from the little wound in the vessel, at the bend of the arm, as high up as the right auricle of the heart; and of the latter by what takes place in chancre, where the poison, taken up by the absorbent vessels of the penis, is carried by them to the glands of the groin, where it causes a hard and painful swelling, constituting what is termed a bubo. In dissection wounds the absorbent vessels always serve as vehicles for the transmission of the peculiar poison which gives to these lesions their characteristic features. For a short period after inoculation the poison is apparently latent, when its effects show themselves by one

or more red lines extending up the limb as far as the axillary glands, whence, as from a common centre, its injurious consequences are radiated over the whole system.

Of the extension of inflammation by *nervous agency*, or sympathy, a familiar example is afforded in parotitis. In this disease, which attacks chiefly young subjects, the inflammation often suddenly leaves the organ originally involved, and fastens itself upon the testicle, which is then compelled to bear the whole onus of the morbid action. Of the precise manner in which this transfer is effected we are ignorant. That it is not through any direct nervous connection is sufficiently obvious, for everybody knows that no such connection exists; hence, as the only plausible explanation left us, we must conclude that it is brought about by the operation of sympathy, although of the nature of this operation it is impossible, in the present state of the science, to form any just idea. A similar relationship exists between the mamma and uterus, the stomach and lungs, and between the stomach and brain, or, rather, between the former organ and the arachnoid membrane.

Finally, inflammation may be propagated by the *blood*. This fluid, as will afterwards appear, undergoes various changes in this disease, of which the most important is an increase of fibrin and colorless globules, with a strong tendency of these substances to adhere to the sides of the vessels as they are propelled along with the general circulating mass. The blood, thus altered in its properties, leads to obstruction of the capillaries in different parts of the body, thereby establishing foci of morbid action. It is not improbable that metastatic abscess, or what is now called pyemia, is generally produced in this way; at all events, this is a more rational mode of accounting for that occurrence than the one which attributes it to the absorption of pus, or the admission of this fluid, into the blood, through the agency of open-mouthed veins.

3. VARIETIES OF INFLAMMATION.

With the exception, perhaps, of the epidermis, the hair, and nails, there is no part of the human economy which is not susceptible of inflammation and its consequences. The reason why these structures are usually considered as incapable of this process is, that we are not able to demonstrate in them any bloodvessels, nerves, and lymphatics, which are the great and essential elements of organization in the more thoroughly elaborated and complex tissues. Notwithstanding this, it is extremely difficult to unite in so sweeping a conclusion, when we reflect upon the fact, of which daily observation furnishes examples, that these external coverings undergo various lesions, of form, size, color, and consistence, which can only be explained on the assumption that they are the product of inflammation, modified by the nature of the affected parts. There are other structures, as the arachnoid membrane, the cornea, and some of the cartilages, in which it is impossible to detect vessels, and yet no one would doubt for a moment, on this account, that they are incapable of disease. We should, therefore, I

think, not make any exception, as it respects the possibility of the occurrence of inflammation, even in regard to the scarf-skin, the hair, and nails.

The susceptibility of a part to inflammation may be stated to be, as a general rule, in direct proportion to the amount of its vascular and nervous endowments, the importance of its functions, and the nature of its exposure. Hence it is found to be most common in the skin, cellular tissue, the mucous and serous membranes, the joints, lungs, liver, kidneys, bladder, urethra, ovaries, and uterus. The only exceptions to this law are the brain and heart, which, notwithstanding their incessant labor, the excessive delicacy of their organization, and their universal sympathetic relations, are comparatively rarely the subjects of inflammation. In the thyroid body, the salivary glands, the pancreas, the prostate, and the spleen, together with the voluntary muscles and their tendons, the nerves, vessels, fibrous membranes, and even the bones, the disease is also quite uncommon, although several of these structures are sufficiently prone to suffer from inflammation as it manifests itself in certain forms of syphilis, scrofula, and rheumatism. It is easy to know why the skin should be so frequently diseased when we reflect upon its vast extent, its wonderful vascularity and nervous endowments, its sympathy with the brain, lungs, stomach, and, in fact, almost every organ in the economy, and its constant exposure to all kinds of injurious impressions. For the same reason it is not difficult to account for the frequent occurrence of pneumonia, hepatitis, nephritis, and inflammation of some of the other viscera. The cellular tissue, although less highly organized than the skin, is yet a frequent subject of disease, growing out of the circumstance that it is the great connecting link by which the various tissues of the frame are cemented together, and also that it serves as a means of transmission of the vessels and nerves from one part to another. The functional activity alone of some of the organs affords a ready key to their liability to inflammation. Thus, the genital organs are almost exempt from disease until the age of puberty; but from that time on, when their slumbering season is over, and their fretful life begins, they are extremely prone to take on morbid action, both of a common and of a specific character.

The progress of inflammation exhibits much diversity, being at one time rapid, at another slow; hence its distinction into *acute and chronic.* An acute attack is one which runs its course swiftly, and which is characterized by well-marked symptoms, as is seen, for example, in tonsillitis consequent upon a severe cold, and where, in the space of a few days, the affected gland acquires a large bulk from vascular engorgement and interstitial deposits, attended with great local and constitutional disturbance. Force and rapidity of action are its distinguishing features. Chronic inflammation, on the contrary, is marked by comparative slowness and feebleness of action; the attendant phenomena are also less bold, although there is generally a decided tendency to effusion. It may be the sequela of an acute attack, or it may show itself as a primitive affection; that is, it may exist for a considerable period without being discovered, owing to the absence

of the usual diagnostic signs. Once in this condition, it may last almost for an indefinite time, as is exemplified in certain cases of gleet, leucorrhœa, tonsillitis, osteitis, arthritis, otorrhœa, and ophthalmia.

Inflammation may be *healthy* or *unhealthy*, according as it manifests a tendency to restoration, progress, or mischief. It would be wrong to regard inflammation always in the light of a disease, since it is the means which nature must necessarily employ whenever she wishes to repair the injury which has given rise to it. It is only when the process proceeds blindly, so to speak, that it is likely to be productive of harm by overpowering the part and system. An incised wound, occurring in a sound constitution, will, if properly managed, heal promptly by union by the first intention; but if the reverse be the case, there will not only be no immediate union, but its edges will separate, and suppuration taking place, a long time may elapse before consolidation will be completed. In the one case, the action is said to be healthy, in the other unhealthy; and it will generally be found that the nature of the action is a true index of the condition of the part and system; as the latter is, so will be the former. There are of course exceptions to this law, but they are infrequent and unimportant.

There is a form of inflammation to which pathologists have applied the term *irritable*, but which in reality does not differ materially from unhealthy inflammation, just described. The best illustrations of it occur in strumous ophthalmia, in ulcers of the extremities, in rupia, and in chronic tonsillitis, bronchitis, dysentery, cystitis, urethritis, and orchitis. It seems to depend upon an exaltation of the natural sensibility of the affected structures, aggravated by an unsound state of the nervous system.

Inflammation may be *common* or *specific;* common, when it proceeds from ordinary causes; specific, when it is produced by some peculiar poison, as the matter of gonorrhœa, syphilis, or smallpox. A more important distinction is that certain inflammations are capable of appearing only in certain tissues. Thus, erysipelas is generally a disease of the skin; in rare instances it affects the mucous membrane of the mouth and throat, and, perhaps, also the peritoneum and pelvic veins, as in lying-in females; but it never fastens itself, as a primary affection, upon the muscles, aponeuroses, nerves, arteries, bones, cartilages, or internal viscera. Gout and rheumatism have a special fancy for the joints and fibro-serous textures; secondary syphilis, for the skin and fauces; tertiary syphilis, for the bones and periosteum; scrofula, for the lymphatic ganglions; and carcinoma, for the glandular structures, as the mamma, uterus, and liver.

Finally, inflammation may be *latent.* This expression is curious, and yet full of meaning; it simply implies that the morbid action does not reveal itself by the ordinary phenomena. Such an inflammation is always to be dreaded, because, being of a peculiarly insidious character, it is extremely apt to be overlooked. One of the best examples of this form of disease is afforded by the glands of Peyer in typhoid fever, the inflammation and ulceration of which constitute the anatomical lesions of that singular malady. Patients thus affected seldom complain of pain, or, indeed, of any other suffering directly

referable to these bodies, even when the morbid action is so extensive as to lead to perforation of the bowel. Latent pneumonia is a sufficiently common disease, and abscesses of the spine and other parts of the body often make great progress before their true nature is even suspected.

4. TERMINATIONS, OR EVENTS OF INFLAMMATION.

Inflammation has various modes of termination; upon strict inquiry, however, it will be found that these amount only to two, and that all the rest are merely so many states, conditions, or events of the process. This distinction is real, not imaginary, and therefore of no little practical value. Philosophically speaking, there are but two terminations of the morbid action, the one being in health, the other in the death of the part. The former may occur by delitescence and resolution; the latter, by ulceration and gangrene. All deposits, whether serous, plastic, purulent, or sanguineous; and all changes of structure, whether in the form of softening, induration, contraction, or thickening, are to be viewed simply as so many products, effects, or results of inflammation, without necessarily involving a suspension of the process itself. This indeed may still go on, sometimes even for an indefinite period, and thus produce additional changes, more serious, perhaps, in their consequences than those which attended the act in its earlier stages. In suppuration, for example, the inflammation does not generally end the moment matter forms, or as soon as the pyogenic crisis has been fairly attained; instead of this it proceeds in a modified state, accompanied by ulceration, or still further deposits. The same remarks are applicable to lymphization and even to the production of serum, the latter of which may be regarded as one of the processes employed by nature to deplete the inflamed tissues; in this, however, she generally succeeds only by degrees, as is shown by the fact that the disease often continues for a considerable length of time after the drainage has commenced. Blood, either perfectly pure, or variously combined with the secretions of the affected surface, may be poured out quite freely, and yet the morbid action continue as actively as before, as we see exemplified in dysentery and other hemorrhagic forms of inflammation. Hence there is really no such thing as a termination of inflammation in effusion of serum, deposit of fibrin, or the formation of pus. These events occurring, the morbid action may still go on, being merely modified in its character by the influence exerted upon it by the attendant secretion or the morbid product.

The *nomenclature* of inflammation has been much simplified within the last quarter of a century. As it now stands it is based essentially upon the anatomy of the affected tissue, structure, or organ, the term *itis* being merely added to the name by which it is generally known, as sclerotitis, cystitis, laryngitis. Sometimes, however, the old expressions are retained, as quinsy for inflammation of the tonsils, ophthalmia for inflammation of the eye, and gonorrhœa for inflammation of the urethra.

SECT. II.—ACUTE INFLAMMATION.

The symptoms of inflammation naturally divide themselves into local and constitutional; or those furnished by the part and those afforded by the general system.

1. LOCAL SYMPTOMS.

The most prominent external symptoms of inflammation have long been known to practitioners. They are tersely stated by Celsus to be "rubor, calor cum tumore et dolore." This writer flourished in the first century of Christianity, and was a contemporary of Virgil, Horace, and Ovid. His knowledge of inflammation, however, was extremely imperfect, and it was not until some time after the commencement of the present century that the subject began to be studied in its relations with the different organs and tissues of the body. Bordeu, Carmichael Smith, and Bichat, by laying the foundation of general anatomy, paved the way to a more comprehensive acquaintance with the nature and seat of morbid action, and were thus instrumental in revealing an amount of light, the beneficial effects of which can even yet be hardly foreseen. They have shown us, what might, *a priori*, have been anticipated, that the phenomena enumerated by the Roman author, as characteristic of inflammation, are liable to great and constant variations, according to the nature of the affected structure, and that the most violent morbid action may often be present, and yet nearly all of these phenomena be absent. Hence, at the present day, too much stress cannot be laid upon disordered function, inasmuch as this is frequently the only symptom that is at all appreciable, especially in inflammation of the internal organs. Modern research has shed important light upon the condition of the capillary vessels and their contents in inflammation, and has enabled us to explain much of what was before obscure and mysterious in regard to the more intimate nature of the process.

1. *Discoloration.*—The discoloration of an inflamed part varies from the slightest increase of the natural hue to the deepest purple, according to the character of the affected tissues and the intensity of the morbid action. It is always, other things being equal, most distinctly marked in those structures which are very vascular, while in such as have comparatively few vessels it is either entirely wanting, or present only in a faint degree. It is a prominent phenomenon in inflammation of the skin and mucous membranes, the cellular tissue, lungs, pleura, spleen, kidneys, and peritoneum; structures which are distinguished by their great vascularity, and by the large amount of blood which they are capable of admitting in disease. On the other hand, there is but little discoloration in inflammation, however intense, of the tendons, cartilages, bones, and fibrous envelops, the brain, nerves, heart, and voluntary muscles. In inflammation of the arachnoid membrane the only evidence of disease observable after death is effusion of serum

or of serum and fibrin; all trace of vascularity is wanting, and yet the morbid action has been sufficient to destroy life.

The discoloration of inflammation often acquires a high grade in a very short time, depending upon the activity of the circulation of the affected structures. In general, however, it proceeds rather slowly, keeping steady pace with the ingravescent action; advancing from rose to red, from red to purple, or from purple to black, as when the part is about to fall into mortification. It is always most distinct at the focus of the inflammation, from which it gradually recedes until, in most cases, it is insensibly lost in the natural hue of the surrounding healthy structures. Occasionally, however, as in erysipelas of the skin, as well as in some affections of the mucous membranes, the line of demarcation is very abrupt, the diseased surface exhibiting a red and well defined circle.

The discoloration varies not merely in degree, but also in its character, thereby throwing, not unfrequently, important light upon the diagnosis of the case. Thus, it may be scarlet, as in the skin, throat, and bowels; lilac or bluish, as in the sclerotica and the fibrous envelops of the muscles; brick-colored, grayish, or brownish, as in iritis; yellowish, as in erysipelas, especially when associated with derangement of the biliary secretion; of a copper hue, as in the eruptions of secondary syphilis; purple, as in the edges of a scrofulous ulcer; livid, as in violent tonsillitis; and black, as in mortification. These varieties of color, in these and other structures, are dependent, partly upon the organization of the affected tissues, partly upon the nature of the inflammation itself, and partly upon the amount, degree, or intensity of the morbid action.

The discoloration varies in extent, from the smallest speck, perhaps not larger than a pin's head, to a surface occupying many inches, if not several feet in diameter, as in erysipelas, where the disease sometimes involves the greater portion of the body. When this is the case, the discoloration is said to be diffuse; it is arborescent, when the vessels upon which it depends are spread out in dendritic lines; punctiform, when it occurs in the form of little dots, or points, as in some of the inflammations of the serous and mucous membranes; linear, when it presents itself in a distinct streak, as in phlebitis and angeioleucitis; and maculiform, when it assumes the appearance of a blotch, or ecchymosis. In the latter case, as well as in the punctiform variety of discoloration, the morbid hue is due to an actual extravasation of blood, consequent upon a rupture of some of the capillary vessels of the part.

To be of value as a diagnostic sign of inflammation, the discoloration must be permanent, not transient; advancing and receding with the morbid action; disappearing under pressure, but reappearing the moment the pressure is taken off. The blush of shame vanishes in an instant, with the excitement that produced it; and the hectic flush upon the cheek of the consumptive merely denotes the existence of the fever which succeeds the afternoon's rigor; they are very different from the discoloration which marks the rise, progress, and termination of inflammation. Besides, the latter is usually associated with other symptoms,

as heat, pain, swelling, and disordered function; phenomena sufficiently distinctive, in every case, to prevent error of diagnosis.

The immediate cause of the change of color in inflammation, is a preternatural afflux of blood. It was formerly supposed that it depended upon the formation of new vessels, but the fallacy of this opinion was long ago disproved by minute injection and microscopical observation. It is now well known that there is a class of capillaries too delicate to admit a sufficiency of red blood to render them visible in the natural state, but which, the moment they become involved in irritation or inflammation, are distended to such a degree as to show themselves in every direction, hundreds and even thousands appearing, and that frequently in an instant, where hardly any could be discerned before. We see this fact exemplified in the vessels of the conjunctiva, when a particle of foreign matter lodges upon the cornea; and what occurs here may be supposed to take place, under similar circumstances, in other structures. It is only in reparative inflammation, or in the inflammation which is necessary to rebuild parts that have been lost or destroyed, that vessels are ever formed. The process is entirely incompatible with ordinary inflammation.

2. *Pain.*—Pain, like discoloration, is one of the most constant symptoms of inflammation, usually setting in early in the disease, going on steadily increasing until the morbid action has attained its maximum, and then gradually abating, as the disease recedes until it is insensibly lost. The subject of pain presents several points of interest, which, as they have a practical importance, should be well understood by the surgeon.

Pain varies in degree from the slightest change in the normal sensibility of the part, to the most excruciating agony, according to the nature of the affected structure, and the intensity of the morbid action. Doubtless idiosyncrasy also exerts an important influence, for it is well known that what causes pain in one individual occasions little, if any, in another. Most persons bear the application of a blister well, but I have seen some in whom the remedy, although retained only for a few hours, was productive of the most exquisite torment. Such a result can only be explained on the assumption of an idiosyncrasy, or a difference in the nervous organization of our patients. The same remark is true in regard to the effects of injury. As a general rule, the pain is greatest at the focus of the inflammation; it is usually fixed in its situation, but sometimes it darts about in different directions; is increased by pressure, motion, and posture; and rarely intermits, although it often remits, especially in the morning and the early part of the forenoon.

Much diversity obtains in regard to the character of the pain, so much so, indeed, that we may often, from this circumstance alone, form a tolerably correct idea of the seat, and even of the nature, of the inflammation. Thus, in the pleura it is sharp and lancinating; in the cellular tissue, acute and throbbing, as is exemplified in boil and carbuncle; in the liver and lungs, obtuse and heavy; in the skin, prurient, itching, or burning; in the bones, dull and gnawing, as if insects

were feeding upon the part; in the urethra, scalding or burning; in the conjunctiva, gritty and itching; in the teeth, throbbing, beating, or pulsatile. When inflammation is about to terminate in mortification, the pain generally becomes hot and burning.

Pain is sometimes felt at a point more or less remote from the seat of the morbid action; hence, it does not always serve to denote its existence. In coxalgia, a strumous affection of the structures of the hip-joint, the earliest and most prominent symptom usually is severe pain in the knee, and it has often happened, especially in the hands of the ignorant and inexperienced practitioner, that the latter has been leeched, cupped, and blistered, when all this care should have been bestowed upon the former. In inflammation of the bladder, ureters, and kidneys, a prominent symptom is uneasiness in the head of the penis; and in hepatitis, considerable suffering is often felt in the right shoulder. It is not always easy to explain these occurrences; but, in general, they are dependent either upon continuity of structure, as in the case of the urinary passages, or upon reflex action, as in coxalgia and hepatitis.

It is worthy of note, that the pain is generally much more severe when the inflammation is seated in the covering of an organ, than when it occupies its proper substance. A pleuritis is always attended with severe local distress, whereas few persons ever experience any pain in pneumonitis. In inflammation of the parenchymatous structure of the liver, great disorganization may take place, and yet the patient be entirely ignorant of the fact, as far as pain is concerned; but should the fibro-serous envelop of the organ be mainly implicated, violent suffering will be a prominent symptom. The same law holds good in inflammation even of the brain and its membranes.

It is important that the practitioner should be aware of the distinction between the pain of inflammation and the pain of spasm, since it must exert an important influence upon his therapeutic measures. It has been already seen that the former is gradual, not sudden in its attack; persistent, not intermittent; increased by motion, pressure, and posture; moreover, it is generally accompanied by more or less febrile disturbance, and other evidences of indisposition, plainly marking its character, to say nothing of the history of the case, which usually furnishes important light in regard to the diagnosis of the individual case. In spasm, the pain comes on suddenly, and, after having continued for a short time, intermits, or entirely disappears, only, however, to return again, and pass through the same course; in a word, it is paroxysmal, coming suddenly, and going suddenly; relieved by pressure, and nearly always attended with eructations and rumbling noises in the bowels, supposing the case to be one of colic; there is no fever—indeed, generally no constitutional excitement of any kind—and there is also an absence of the other local symptoms of inflammation, as heat, discoloration, and intumescence.

In neuralgia the pain is sharp and lancinating, often darting through the parts with the rapidity of lightning, or like an electric shock; accompanied by a sense of soreness or aching, and generally aggravated by pressure. It is usually paroxysmal in its character, coming on per-

haps once every day, lasting a few hours, and then going off gradually, or even suddenly, to reappear about the same time the following day; it is, in fact, generally an intermittent disease, with a distinct interval of freedom from pain, resembling, in this respect, an ordinary intermittent fever, and having often, like it, a miasmatic origin. The pain, moreover, is not always fixed, but is at one time here, and at another there, generally in the course of a sentient nerve.

Severe pain, especially in a nervous, irritable person, is always a formidable occurrence, as it exhausts and depresses the powers of life, and is sure, if not timeously combated, to occasion serious, if not fatal, mischief. The rule, therefore, is to arrest it promptly, and at all hazard, before the disease, of which it is a symptom, has made much progress.

A sudden disappearance of pain, unless occasioned by the use of anodynes, is generally denotive of danger, as it implies a termination of the morbid action in the death of the affected structures. The occurrence should, at all events, excite suspicion, and lead to careful investigation. An individual has been the subject of strangulated hernia; the constriction has lasted for several days, and has been characterized by severe suffering, both local and general; suddenly the pain ceases, and the patient flatters himself that he will soon be well. The surgeon, however, comes to a widely different conclusion; for the sunken features, the clammy skin, the feeble and flickering pulse, the incessant hiccough, and the trembling hand but too plainly foreshadow the approach of death from mortification of the bowel.

Pain is not always present, even although the inflammation may be extremely violent. In typhoid fever, a disease attended with inflammation of the glands of Peyer, often terminating in extensive ulceration of these bodies, there is generally an entire absence of this symptom, from first to last, unless the case is followed by perforation of the bowel, and an escape of its contents into the peritoneal cavity. In pneumonia there is frequently no pain whatever; and the same thing is true in relation to inflammation of some of the other viscera. In scrofulous affections of the spine, particularly those forms of it known as Pott's disease and psoas abscess, pain, properly so called, is one of the rarest phenomena, especially in the earlier stages of their progress. A painless inflammation is peculiarly dangerous, inasmuch as it is very liable to be overlooked by the professional attendant, particularly one who is in the habit of placing undue confidence in the ordinary phenomena of the disease.

How is pain produced? It has been supposed that it is caused by a development of new nerves; but that this is not so is sufficiently established by the fact that this symptom is often present, and that in a very severe degree, almost at the very commencement of the morbid action, and, consequently, long before it is possible for such an occurrence to take place. A more plausible opinion is that the suffering is occasioned by the compression of the nerves of the part by the dilated vessels and the effused fluids; but to render this theory complete it is necessary to go a step further, and to suppose that the various component structures of the nerves themselves are inflamed. It can

hardly be imagined that these structures should escape this action even in the milder grades of inflammation, much less when the disease is fully established.

Of the intimate nature of pain nothing is known. All that observation teaches us is that it is a peculiar mental perception, dependent upon a healthy state of the brain, without which it is impossible for it to occur. The individual must possess the faculty of consciousness, or he cannot take cognizance of the mischief that disease produces in the different organs and tissues of the body. We have a convincing proof of this in what occurs in apoplexy and paralysis of the lower half of the body, in which the most violent inflammation may be set up, both in the internal viscera, and in the external structures, and yet the patient be utterly insensible of its presence. The brain and nerves are crippled; hence the latter are unable to convey, and the former unable to receive, painful impressions of any kind.

Although pain is undoubtedly a great evil, yet it is extremely fortunate that it is so generally present in inflammation, since it serves to warn the patient of his danger, and often imparts to the practitioner useful information respecting the nature and seat of the morbid action. How many persons formerly perished of typhoid fever, simply because there was no pain to guide the physician to the true lesions of the disease! Doubtless this affection has existed from time immemorial, but it has only been within the last quarter of a century that we have known anything definite of its seat and character. Were pain one of its prominent symptoms, it would long ago have pointed the practitioner to the condition of the glands of Peyer.

What is termed *throbbing* is a peculiar form of pain, generally denotive of the approach of suppuration. It is, however, sometimes felt at an early stage of the morbid action, especially when it involves the fibrous, fibro-serous, and osseous tissues. It is generally dependent, in the first instance, upon an unusually crowded state of the capillary vessels, impeding the onward flow of blood, and afterwards, when the disease is more fully developed, also upon the presence of inflammatory products. Posture exerts an important influence upon its production, as is evinced in whitlow, odontalgia, and common furuncle. In the first of these affections the pain is increased a hundred-fold, almost in an instant, when the hand is permitted to hang down by the side of the trunk; a decayed tooth that is free from pain in the day, while the patient is sitting up or walking about, will ache violently the moment the head touches the pillow at night; and a boil on the buttock, which will cause hardly any uneasiness when the body is recumbent, will throb violently when it is erect. These occurrences, which are easily explained by the increased determination of blood which the affected structures receive under such circumstances, teach a valuable practical lesson in regard to the importance of position in the treatment of inflammation.

3. *Swelling.*—Swelling is seldom entirely absent in inflammation of the external parts of the body, although it may be in that of certain internal structures, however violent or extensive the morbid action. Under the latter head may be enumerated, in particular, the fibrous and

serous membranes, the tendons, cartilages, bones, vessels, and nerves, along with most of the different viscera. The mucous membranes also rarely suffer in this way; the principal points where swelling is liable to occur, as a result of inflammation, are the conjunctiva, glottis, tonsils, and vulva, for the reason that these parts are largely supplied with lax cellular tissue, which, wherever it exists, is so permissive of infiltration of serous and other fluids. Hence it is that swelling is generally so conspicuous in inflammation of the subcutaneous and intermuscular filamentous substance, especially in the extremities, and even sometimes in the head, as is noticed in the more severe forms of erysipelas, where the scalp and face are occasionally puffed up to an enormous extent, frightfully disfiguring the features.

The progress of the swelling varies; in general it is gradual, commencing early in the inflammation, and going on steadily increasing until the morbid action has attained its height; even then, however, it does not always stop, but often continues until the vessels have parted with their more fluid contents, which sometimes occurs only after the disease has begun to decline. Occasionally, however, cases are met with where the swelling is most rapid and extensive, spreading, in a short time, over an entire limb, or even over the greater portion of the body. The best examples of this occurrence are witnessed in certain injuries, as compound fractures and dislocations, phlegmonous erysipelas, and the inflammation consequent upon snake-bite.

The swelling varies in its character; thus it may be soft or hard, transient or protracted, beneficial or injurious. A soft swelling is usually denotive of serous effusion; a hard one, of a deposit of fibrin, or of the more solid elements of the blood. A transient swelling is a more desirable event than a protracted one, as it is less likely to interfere with the restoration of function. Swelling often proves beneficial, inasmuch as the effusion upon which it depends is a means of depletion employed by nature to relieve inflammatory action; it answers in fact, the same purpose as topical bleeding. When, however, the deposit is very large, or composed essentially of solid material, immense harm may be produced by it, from the manner in which it compresses the capillary vessels and interferes with the transmission of their contents; in other words, the effusion acts obstructingly, and thus causes fatal constriction. In swelling of the conjunctiva, technically called chemosis, the matter poured out often compresses the vessels of the cornea in such a manner as to induce gangrene of this membrane; and a like result occasionally follows phlegmonous erysipelas of the limbs and scrotum. Swelling may prove injurious in another way; by acting obstructingly, as in œdema of the glottis, which may cause death by preventing the ingress of the air into the lungs. A similar effect may be produced by inordinate tumefaction of the tonsils. A swollen perineum may compress the urethra and occasion retention of urine.

The immediate cause of swelling is twofold; first, engorgement of the capillary vessels, and secondly, and mainly, effusion of serum and fibrin; to which, in the more severe forms of inflammation, may be added pus and blood, the latter of which is sometimes poured out in considerable quantity.

4. *Heat.*—An increase of heat is one of the most common effects of inflammation, and hence a valuable symptom of the disease. A good illustration of this occurrence is observed in tonsillitis, gastritis, pneumonia, and the so-called fevers, in which there is often a remarkable heat of the breath; and also in many of the external varieties of inflammation, where the change is rendered apparent both by the sense of touch and by the rapid evaporation of our applications. The scalding tear in inflammation of the eye is an evidence of the same fact.

The degree of heat, emitted in the act of inflammation, has been supposed never to exceed that of the blood in the heart and large vessels. The researches of Mr. John Hunter would seem to countenance this opinion. He operated upon a man for the radical cure of hydrocele; the temperature of the vaginal tunic immediately after the withdrawal of the fluid being 92°. The cavity was now stuffed with lint, and the next day the thermometer stood at 98¾°, thus showing an increase of six degrees and three-quarters, which must have fully equalled the heat of the blood in the heart and large vessels of the subject of the observation. In repeating the experiment subsequently upon a muscular wound in the side of a dog, and upon the vagina of an ass, irritated by a solution of bichloride of mercury, he found no difference whatever, before and after the occurrence of inflammation, in the temperature of the parts. Hence, he naturally concluded that the extrication of heat during the progress of this morbid process was either very slight, or altogether inappreciable. Observations, however, made since the time of the English philosopher, conclusively show that there is frequently, if not generally, a decided increase of temperature in the inflamed structures; and, although this increase may not render the temperature of the part equal to that of the heat of the blood in the heart, yet it is none the less real and positive. It is well known that the outskirts of the body, as the feet, hands, and ears, are habitually cooler than the trunk, head, and upper portions of the extremities, because they have naturally a more feeble circulation; hence in inflammation, although their temperature may not reach 98° of Fahrenheit, yet if there be any elevation of heat over and above what these structures enjoy in the healthy state, it is to be considered as an actual augmentation. That this will generally be found to be the fact, in all the more severe forms of inflammation, my observations, many times repeated, fully convince me. In erysipelas of the skin of the trunk, in urinous infiltration of the scrotum, in acute abscess, in tonsillitis, orchitis, bubo, and other affections, I have again and again seen the mercury rise in the instrument above 100°, and in some instances even as high as 105°, 106°, and 107°. It has been ascertained that the oviduct of a frog ready to spawn is two degrees hotter than the heart; and Professor Dunglison has seen the temperature of the uterus during labor as high as 106°. From all these facts, to which others equally convincing might be added, if space permitted, it is impossible to avoid the conclusion that there is generally an elevation of heat in inflammation, in whatever part of the body it may be situated, provided the action which accompanies it is not too slight, or too limited in extent.

Our knowledge of the nature of animal heat is hardly sufficient to justify us in expressing an opinion regarding the cause of its increase in inflammation. It may be supposed, however, in the absence of positive information, that it is due to the friction which the blood experiences in its passage through the vessels, not only in the inflamed parts, but in the system at large, and also to the rapid manner in which the oxygen of the air unites with the red particles of this fluid as it is propelled along in its turbulent course. The influence of an accelerated state of the circulation upon the production of animal heat is well exemplified in what occurs in ordinary exercise when the feet are cold. A rapid walk, under such circumstances, in the open air, soon equalizes the circulation, and sends the blood, loaded with oxygen, to every part of the body, warming and fertilizing it as it rushes on. If a horse be rode swiftly round the race track his whole body becomes immensely heated, and his blood surcharged with fibrin and colorless globules; both evidently the result of the increased friction of the blood against the coats of the vessels, and the rapid union of the oxygen of the air with that fluid. Irritating applications, as spirits of ammonia, blisters, sinapisms, and embrocations, by inviting a preternatural afflux of blood to the affected part, produce an analogous effect, accelerating the circulation, and causing an elevation of temperature. Allusion has already been made to the fact that the uterus during parturition is much hotter than it is in the natural state; a circumstance which can only be explained by the supposition of an increased activity of its vessels approximating a state similar to that which obtains in inflammation, although not identical with it. During the growth of the antler of the deer and other animals there is always a marked elevation of temperature; and phenomena of a similar kind are often witnessed during the development of malignant and other tumors. All these circumstances bear directly upon the question under consideration, if they do not positively serve to establish its truth.

5. *Functional Disorder.*—Disorder of the functions of the affected part is in general a most important symptom, being often present when all, or nearly all, the other phenomena are absent. It manifests itself in various ways, as well as in various degrees; at one time in the form of increased sensibility or irritability, at another as a suppression, alteration, or augmentation of the natural discharge, and now as an abolition of some special sense; at one time as the slightest possible departure from the normal action of the part, and at another as a total suspension of it.

An increase of *sensibility* is one of the most common effects of inflammation. In peritonitis, gastritis, and enteritis, the sensibility of the affected structures is often so great as to render the slightest pressure of the finger a source of profound distress; and it is for the same reason that, under such circumstances, the weight even of a sheet is sometimes almost intolerable. Similar effects are noticed in some of the external diseases, as in boil, carbuncle, erysipelas, and in inflamed hæmorrhoidal tumors, which are frequently the seat of the most exquisite tenderness, hardly exceeded by that which attends an

inflamed eye. Parts which are devoid of feeling, or nearly so, in the sound state, as ligaments, tendons, bone, and fibrous membranes, generally become exceedingly sensitive in inflammation. The change in question is of great importance in a diagnostic point of view, inasmuch as it generally enables us to distinguish readily between inflammatory and spasmodic affections, the latter of which, as before stated, are often immensely relieved by pressure, which never fails to aggravate the former.

An increase of *irritability* is a very constant phenomenon in all inflammations of muscular parts. In cystitis, one of the earliest and most prominent symptoms is a frequent desire to urinate, arising from involvement of the muscular fibres of the bladder; in gastritis, the irritability of the stomach is often so excessive that the organ is incapable of retaining the smallest quantity of fluid, however bland; and in dysentery, the greatest distress which the patient is obliged to endure, during the progress of that dreadful malady, arises from the incessant peristaltic action of the colon and rectum, the main seats of the morbid action. An increase of the contractility of the voluntary muscles is very common in fractures and dislocations, in severe sprains, and after amputations, usually manifesting itself in spasmodic twitchings, which often require large doses of anodynes for their suppression.

Again, inflammation has the effect of diminishing, or even completely suspending, the special function of an organ. In ophthalmia, the eye cannot look at objects, however dim; the moment the effort is made the lids contract spasmodically, and the smallest ray of light that impinges upon the retina is productive of the greatest distress. In inflammation of the ear the slightest noise, which, in the healthy state would perhaps not be perceived, or which might fall as delightful music upon the tympanum, becomes a source of deep distress; and the sense of hearing is almost destroyed by the buzzing and explosive sounds which succeed the morbid action. In coryza, the sense of smell is abolished; in inflammation of the skin the patient is deprived of the sense of touch; and in glossitis there is a loss of the sense of taste. In laryngitis the voice is at first merely altered in its character, but as the disease progresses the individual often becomes completely aphonious. In cerebritis there is generally delirium, followed, if the case passes on to suppuration, by convulsions and coma, the precursors of speedy dissolution.

Another prominent symptom of inflammation, one, indeed, which is seldom absent, is disorder of the *secretions*. Thus, in inflammation of the skin, there is suppression of the perspiration; in hepatitis, of the bile; in nephritis, of the urine. Or, instead of a total arrest of these and other secretions, important changes are effected in their composition or in their physical, chemical, and microscopical properties. In pneumonia, the characteristic symptom is a rust-colored sputum, and in dysentery, a discharge of bloody mucus.

The function of *absorption* is often seriously impeded, if not completely arrested, in inflammation. The disorder, however, is generally much more conspicuous in the advanced than in the early stages of inflammation, in which this process is sometimes executed, even with

a certain degree of vigor, as is demonstrated by the facility with which morphia and other substances are carried into the system when placed upon the skin after vesication by cantharides, ammonia, or hot water. In the more violent grades of inflammation, the function is usually kept in a state of abeyance, the action of the absorbent vessels being arrested by the morbid deposits. Afterwards, however, as the disease declines, the function of absorption is gradually re-established, and then often proceeds with great vigor, rapidly removing the fluids effused during the earlier stages of the inflammation.

It is worthy of notice that while the absorbent vessels, when the inflammation is at its height, refuse to take up extraneous matter, as, for example, morphia or belladonna, and also effused fluids, they are often very busy in removing affected textures, and that even when they are of a very firm and resisting character. A familiar illustration of this occurrence is afforded in acute abscesses, the natural evacuation of which is frequently accomplished by the agency of the absorbent vessels, where the disease is most intense. In inflammation of the joints, cartilage and even bone often suffer extensively from this cause. There is no doubt that the pressure of the effused fluids always greatly influences and promotes the occurrence.

2. CONSTITUTIONAL SYMPTOMS.

Constitutional symptoms do not always attend inflammation. The morbid action may be so mild as to prevent its recognition by the system; it is strictly a local affection, and therefore causes no general resentment. But the case is very different when the disease is severe, or when, even if it is comparatively slight, it involves an important structure; then the whole frame feels its irritating effects, and evinces a strong interest in the impending struggle. The group of phenomena thus produced constitutes what is termed inflammatory, symptomatic, or sympathetic fever, and deserves consideration as expressive of the sum of suffering of each particular organ. The period which intervenes between the establishment of the inflammation and the occurrence of fever varies from a few hours to several days, depending upon the nature of the exciting cause, the condition of the patient, the intensity of the disease, and, above all, the importance of the organ attacked. Idiopathic inflammation is generally preceded by depression or a sense of lassitude and uneasiness, attended with headache, pain in the back and limbs, bad taste in the mouth, vitiated appetite, and slight chilliness, alternating with flushes of heat. Sometimes the patient is remarkably desponding, or annoyed with disagreeable dreams, and unpleasant forebodings respecting his recovery. He feels uncomfortably, both bodily and mentally, and has a disinclination to exertion. In a word, he is unwell, or in a state intermediate between health and sickness. These phenomena, which are merely the precursors of the fever, which is as yet only in a state of incubation, may be compared, not unaptly, to the fleeting clouds which precede the outbreak of a storm; they appear and vanish for a time, but finally coalescing, they assume their allotted station in the chain

of morbid changes. When fully established, the fever never intermits so long as the cause which has produced it continues in operation; but it generally remits slightly in the morning, and sometimes, though rarely, twice in the twenty-four hours. The vesperal exacerbation usually sets in late in the afternoon, and persists, with but little alteration, until towards morning, when the excitement relaxes its hold, as if in need of temporary repose to meet the gradually recurring emergency. During the calm which is now present, the patient often falls into a refreshing sleep, his thirst and restlessness subside, and the skin is bedewed with a gentle perspiration. Soon, however, the smothered fire is rekindled, and the same scene has to be passed through as before, now, perhaps, augmented by the spread of the morbid action, and the development of new sympathies.

In order to comprehend fully the nature of inflammatory fever, it is necessary that the surgeon should personally interrogate, as it were, every organ of the body which may be supposed to evince any feeling with the affected structures. This inquiry should, as a general rule, embrace an examination of the heart and arteries, the countenance, skin and extremities, lungs, tongue, stomach, bowels, liver, kidneys, and bladder, together with the state of the muscles, brain, and assimilative powers.

Derangement of the *vascular system* is chiefly denoted by the state of the pulse, the principal characteristics of which are frequency, hardness, fulness, strength, and quickness. The number of beats in a minute ranges from seventy, seventy-three, or seventy-five, the average standard in the healthy adult, to eighty-five, ninety-five, one hundred, or even one hundred and twenty, according to the intensity of the disease and the vigor of the constitution. A hard pulse is firm and resisting, rolling under the finger like a tense cord, and as if the blood were sent into it with extreme power; sometimes the artery thrills or vibrates, owing to a partial displacement synchronous with the contraction of the left ventricle of the heart. When the tension is unusually great, it is difficult, by any pressure we can apply, to obliterate the caliber of the vessel. Fulness has reference to the volume of the pulse, which feels as if the artery were expanded beyond its normal size. Strength implies a sensation of preternatural resistance to the finger; while a quick pulse is one in which each beat occurs with great suddenness or abruptness. This quality of the pulse is generally associated with frequency, from which, however, it differs essentially, as the latter has reference merely to the number of strokes in a given time, and not to the rapidity with which the vessel dilates and contracts under the finger. Several of these states of the pulse may be absent, and yet the case be one of great disorder of the vascular system. Their entire co-existence, in fact, is rare; perhaps the nearest approach to it is to be found in gout and rheumatism, hepatitis, pleurisy, splenitis, and the commencement of smallpox.

In the examination of the pulse, it is not to be forgotten that its action may be materially modified by the nature and seat of the inflammation and by the idiosyncrasy of the patient. In cephalic affections, the pulse is slow, full, and laboring, in consonance with the

oppressed condition of the heart; in peritonitis, it is small, frequent, and wiry, sometimes, in fact, almost indistinguishable; and in acute inflammation attended with internal venous congestion, as in certain forms of fever and injury, it is obscure and apparently feeble, but generally rises under the effects of our remedies, or the natural powers of the system. Idiosyncrasy often singularly modifies the state of the pulse. I recollect a middle aged man, once my patient, whose pulse was habitually under forty; and still more remarkable examples of the kind have been witnessed by others. On the other hand, it may be abnormally frequent, beating constantly from eighty to ninety in the minute.

The above peculiarities, whether the result of morbid action, or of individual organization, derive a special value from the influence which they must necessarily exert upon our diagnosis and treatment. Thus, in peritonitis, if the practitioner were merely governed by the state of the pulse, without any knowledge of the condition of the system which causes it, he would be almost sure to administer stimulants instead of applying leeches and blisters; thereby feeding in place of diminishing the inflammation, and so hurrying on the fatal crisis. A pulse, habitually slow, might, in inflammation, hardly attain the normal standard of frequency, and yet the system might literally be consumed by symptomatic excitement. The surgeon, aware of the possibility of such occurrences, is wide awake; and hence he is rarely, if ever, thrown off his guard, whatever may happen.

The *countenance*, in inflammatory fever, is usually flushed, and often appears unnaturally full, as if it were slightly tumid. The eyes are reddish, suffused, and frequently intolerant of light. The skin is hot and dry, perspiration being kept in complete abeyance; and the extremities are usually so warm and uncomfortable as to be unable to bear any covering. When the excitement is excessive, the sufferer generally finds it impossible to maintain the same posture beyond a few minutes; he tosses about from side to side, and from place to place, in search of a cool spot.

The *respiratory organs* freely participate in the general disorder. The inspirations are increased in frequency, and are usually performed with a certain degree of labor; various kinds of râles are heard, and cases occur in which there are well-marked evidences of venous congestion.

The *digestive organs* always suffer in inflammation, and therefore demand careful examination. The tongue is variously affected; sometimes red and almost clean, but generally loaded, either with a whitish, yellowish, or brownish fur, contracted, and somewhat reddish at the tip and edges; nearly always dry, and easily protruded, though often a little tremulous, especially when the accession occurs in a person of nervous temperament. The taste is vitiated, or entirely arrested, the salivary secretion is suppressed, a thick, dark-colored mucus adheres to the lips, gums, and tongue, and there is a disagreeable arid feeling in the fauces and œsophagus. The thirst is intense, and can hardly be appeased by the most frequent and abundant draughts; the appetite, on the contrary, is usually destroyed, and hence the patient often loathes

food, in whatever form it may be presented to him. Nausea and a sense of gastric oppression, sometimes attended with bilious vomiting, are common attendants. The bowels are generally constipated, or alternately constipated and relaxed, distended with gas, and somewhat tender under pressure; the alvine evacuations being fetid, and variously altered in color and consistence. Along with this condition of the digestive tube there is usually more or less disorder of the liver, manifesting itself in excess, deficiency, or vitiation of its secretion. Such a condition is very apt to be present in symptomatic fever consequent upon accidents and idiopathic inflammation in malarious districts. In what manner, or degree, the functions of the pancreas are affected in this disease, we are ignorant. The probability, however, is that it suffers very much in the same way as the salivary glands of the mouth, which it intimately resembles in its structure and uses.

Among the more marked disorders produced by inflammation are the changes effected in the *renal secretion.* These changes relate chiefly to the quantity, color, and consistence of the fluid. In the normal state, the average quantity of urine, in the twenty-four hours, is from thirty-five to forty-two ounces; but in inflammatory fever it often does not reach one-half or even one-third this amount. Moreover, instead of being of a clear amber hue, as it naturally is, it is commonly of a deep red tint, and surcharged with an unusual quantity of mucus and lithic acid; the latter of which, from its greater specific gravity, always falls to the bottom of the receiver, in the form of brick-colored sediment. The odor of the secretion is also generally very much altered, and is often quite offensive from the presence of various kinds of animal substances. The excretion of the fluid is very much as in health, though occasionally it is greatly increased in frequency. Trouble is also sometimes experienced in voiding the urine, especially in traumatic inflammation, as after fractures, dislocations, and amputations, where the bladder is occasionally so much paralyzed as to require the aid of the catheter for the expulsion of its contents.

The *muscles* are generally the seat of great discomfort in this form of fever. Already, during the stage of incubation, the patient is harassed with a sense of lassitude, stiffness, and aching or darting pains, which, gradually augmenting in severity, at length constitute a real source of suffering. The pains in the lumbar region are particularly violent; they are always worst at night, and are often so intense as to deprive the patient completely of sleep. His back feels as if it would break into pieces, as if it were being sawed in two, or as if it were bruised, and mashed, and comminuted. Not unfrequently every joint is racked with pain, and the whole body is so exquisitely sensitive as to be intolerant of the slightest motion, pressure, or manipulation. It is this distress in the muscles that causes the patient such weary and painful nights, and which induces him to exclaim in the evening, "Oh that it were morning!" and in the morning, "Oh that it were evening!"

The suffering of the *brain* is evinced by a peevish and irritable state of the mind; by loss of sleep; by disagreeable dreams; and by occasional fits of delirium. In many cases, there is more or less per-

version of special sensation; as is proved by the distracting noises in the ears, the intolerance of light, the vitiated taste and smell, and the impairment of the touch.

Finally, the *assimilative* powers being in abeyance, the body becomes gradually emaciated, and the strength fails in proportion to the impoverished condition of the blood and solids.

Such is the ordinary course of events in inflammatory fever. If the morbid action does not go on too long, or if the patient has unusual powers of resistance, he may be able to weather the storm, and finally come off conqueror. The disease, and, along with it, the fever which it has produced, will now gradually subside, the occurrence being announced by a diminution of the patient's restlessness, anxiety, and thirst, by a restoration of the moisture of the skin and mouth, and, in short, by a decided improvement in the condition of all the secretions. The sleep becomes more natural and refreshing, the appetite returns, the pulse descends to its normal standard, and the mind regains its natural equilibrium. The cessation of the fever often declares itself by the occurrence, either sudden or gradual, of a profuse sweat, to which the older pathologists applied the term critical, and by a general unlocking of all the secretions. In a word, the clouds which had so long obscured the horizon are once more succeeded by sunshine; disease has vanished, and health is regaining its supremacy.

If, on the other hand, the disease progresses, a downward tendency is gradually witnessed of evil, if not fatal portent. The symptoms, losing their inflammatory type, now assume a *typhoid* character; the pulse becomes weak, soft, and frequent, beating from one hundred and thirty to one hundred and sixty in a minute; the countenance assumes a peculiar shrunken aspect, denominated Hippocratic; the surface is bedewed with clammy perspiration; the extremities are inclined to be cold; the tongue is dry and covered with a brownish or blackish fur; sordes collect upon the teeth; hiccough and twitching of the tendons supervene; and there is rapid emaciation, with corresponding failure of the strength, and low muttering delirium. Recovery is still possible, although doubtful; a well-directed plan of treatment, or even nature's unassisted efforts, may be sufficient to shake off the oppressive load, and enable the part and system to triumph over the ravages of the disease.

But typhoid fever is not always a necessary consequence of the inflammatory; it may, and often does, exist as an independent affection, coming on early in the attack, perhaps almost immediately after the commencement of the morbid action, and maintaining throughout a well-marked asthenic type. The most common cause of such an event is severe shock or loss of blood, occurring in an unhealthy, broken state of the system, or actual blood-poisoning, from the absorption of pus, or the operation of some specific virus, as that of malignant pustule, or that generated in the dead human body, and received by inoculation in dissection. In the more severe grades of erysipelas and carbuncle, the fever soon assumes an asthenic character, whatever may have been its type in the first instance, the system being speedily overwhelmed by the depressing influence of the morbific agent.

The occurrence of typhoid symptoms early in an idiopathic, specific, or traumatic inflammation, always portends evil, as it is necessarily denotive of great and rapid waste of life-power, which neither medicine nor food can, perhaps, successfully counteract. The nervous system is deeply involved in the morbid process; the blood is gradually deprived of its plastic properties; and, nutrition being at a stand, the body soon becomes pale, emaciated, and withered. The mind is early affected, and typhomania is generally a prominent symptom throughout. The vital forces diminishing more and more, the patient, engaged in constant muttering, picks at the bedclothes, has hiccough and twitchings of the tendons, and is so weak as to be unable to support himself upon his pillow. Exhaustion, in fact, is extreme, and a few hours generally suffice to close the scene.

There is another form of fever which is often seen during the progress of inflammatory affections, and to which the term *irritative* has been not unaptly applied, as it is generally met with in persons of a nervous, irritable temperament or habit of body. The best idea that can be given of it is that it bears the same relation to the nervous system that inflammatory fever, properly so termed, sustains to the vascular; that is, the fever is characterized in the one case by irritability, or excess of sensibility, and in the other by plethora, or redundancy of vascular action. We find, accordingly, that in irritative fever there is a lively perception of pain, and an unusual exaltation of sensibility, both of the part and system; the mind is peevish and fretful, easily dissatisfied, and often filled with despondency and unpleasant foreboding; the pulse is quick, jerking, small, and sometimes wiry; sleep is imperfect and disturbed by frightful dreams; the skin is hot, dry, and difficult of relaxation; the extremities are inclined to be cold; and there are frequently nervous rigors, followed by marked reaction, and great restlessness; severe suffering is generally complained of in the loins and muscles; the slightest noise and light are a source of offence; and the head is distracted with severe pain, which often assumes a neuralgic character, and thus becomes a cause of great distress.

There are some low forms of inflammation in which the attendant fever nearly always assumes this peculiar type, being present almost from first to last. A good example of it is afforded in dissection-wounds, in certain injuries of the skull and brain, in phagedenic ulceration, in hospital gangrene, in sloughing chancres and buboes, and in tertiary syphilis, in nervous debilitated subjects.

3. CHANGES OF THE BLOOD IN INFLAMMATION.

That the blood, which plays so important a part in the economy in health, should be seriously altered in its properties in inflammation is what might, *a priori*, have been anticipated, and what observation has fully established to be a fact. Sent with increased force and rapidity through every portion of the body, however constituted, or however remote from the heart; subjected to new actions and new affinities in the suffering structures, as if it were exposed to the heat of

a laboratory, and deprived, in a great degree, of the stimulus of the oxygen of the air, it is not surprising that it should be almost totally changed in its physical, chemical, and vital properties. The most important alterations which the fluid experiences relate to the fibrin and colorless globules, the quantity and number of which are always materially increased in every well-marked case of inflammation. To form a proper estimate of the extent of these alterations it will be necessary to inquire, for a moment, into the relative quantity of these ingredients of the blood in the healthy state.

In healthy blood the proportion of fibrin to the entire mass is as 3 to 1000; in inflammation, however, it is generally very much increased, ranging from 6 to 8, from 8 to 9, and from 9 even to 10½, according to the intensity of the disease and the general powers of the system. In what proportion the colorless globules are augmented in inflammation we are uninformed; that their number is materially increased is sufficiently obvious, but whether the change, in this respect, is as great as in the fibrin, is a point which is still undetermined. In addition to this increase in their number there is a manifest augmentation of their bulk, as well as of their cohesive properties, thereby greatly promoting their tendency to adhesion to the sides of the vessels, which, as will be seen by and by, forms so striking a phenomenon in well established inflammation.

This excess of fibrin and white globules, which is generally observable at an early period of the inflammation, goes on gradually increasing until the morbid process has attained its maximum, when it begins to decline, and finally altogether disappears with the causes that induced it. Although it is most conspicuous in the higher grades of inflammation, there are few cases in which it is wholly absent, unless the disease be so slight as to be incapable of producing any serious structural changes, or material embarrassment in the force and rapidity of the circulation in the part and system. Gout and rheumatism, pleuritis, pericarditis, pneumonia, hepatitis, splenitis, arteritis, and acute articular affections usually exhibit it in a marked degree. It is also present, but less conspicuously, in inflammation of the skin, cellular tissue, and mucous membranes. What is singular, it also exists in the blood in the latter months of utero-gestation. Where or how this excess of fibrin and colorless globules is developed is still a mooted question, which it will require further observation to solve. It may be supposed, in the absence of satisfactory information, that it takes place in the arteries, in consequence of the manner in which the blood is agitated in passing through the different parts of the body, its various ingredients being forcibly pressed and rubbed against each other, and against the sides of the vessels by the increased powers of the heart. Thus a species of disintegration is brought about, which doubtless adds very greatly to the already existing excitement both of the part and of the system. The idea that attrition of the blood against the walls of the arteries is mainly instrumental in the production of the change in question derives support, of a very plausible, if not of a positively confirmatory character, from what is observed when a horse is subjected to severe exercise upon the turf. If he be bled

after having been rode very rapidly round the track, it will be found that there is a great increase of fibrin and colorless globules, in consequence, apparently, simply of the increased momentum of the circulation, and the friction which the blood has experienced in its passage through the vessels, especially the arteries. Now this is precisely what occurs in inflammation: the greater the excitement of the heart, or, what is the same thing, the more intense the morbid action, the greater will be the amount of fibrin and white globules, and the reverse.

This increase of fibrin and white globules is attended with inordinate contraction of the crassamentum, and a separation of the red particles, leading to the formation of what is called the *buffy coat* of the blood. This consists in the appearance of a whitish, bluish, or tallow-like pellicle, upon the top of the crassamentum, which begins to show itself the moment the blood commences to coagulate, and attains its greatest height after the process of consolidation has been completed. Its thickness and density are greatly influenced by internal and extrinsic circumstances, as the state of the system, the intensity of the disease, and the manner in which the blood is drawn. In some instances it is a mere film, while in others it forms a layer several lines in thickness; its density is also subject to considerable diversity, being at one time very feeble, and at another very firm, so much so, indeed, as to offer a good deal of resistance to the finger. When the blood is much impoverished by protracted disease, long abstinence, or unwholesome food, the buffy coat is generally very thin, soft, dirty, and iridescent, forming a striking contrast with the characters which it exhibits in plethoric states of the system.

Various extraneous circumstances materially influence the formation of the buffy coat. Of these the most important, in a practical point of view, are the shape and capacity of the receiver, the size of the stream, and the motion to which the blood is subjected in its passage from the vein. It has been ascertained that the phenomenon is most readily produced when the fluid falls into a deep and rather narrow vessel, and when it issues from a large orifice, at the rate of from two to three ounces in the minute. If the blood runs very slowly, or in a tiny stream, or, if the stream, although quite bold, is received into a cold or shallow basin, it will either not form at all, or so very imperfectly as to be scarcely appreciable. Sometimes the blood is merely sizy, the fibrin resting upon the top of the cruor like a bluish and imperfectly developed film.

Chemically considered, the buffy coat is found to consist essentially of fibrin, in combination with albumen and earthy salts. In fact, it is perfectly identical with the plastic matter that is deposited in inflammation upon the free surfaces and in the interstices of the organs. By a little care it may easily be detached from the upper surface of the crassamentum; and, if it be well washed in cold water and then immersed in alcohol, it will assume not only the peculiar buff-colored aspect, whence it derives its name, but also a dense, firm consistence, the two properties assimilating it rather closely in its physical characters to the substance of the unimpregnated uterus.

Of the manner in which the buffy coat is formed we are unable to offer any very satisfactory explanation. It was formerly supposed that it was owing to the more tardy coagulation of the blood, thereby permitting the red particles to disengage themselves from the fibrin and to sink, by their greater specific gravity, to the bottom of the crassamentum. But this was evidently a mistake; for it is now well ascertained that inflammatory blood, instead of solidifying more slowly than healthy blood, generally concretes very rapidly and firmly, thus impeding instead of favoring the development of the buffy coat. The most recent opinion upon the subject is that the occurrence is due to a vital repulsion between the fibrin and red particles; or, what amounts essentially to the same thing, to an unnatural aggregation of these bodies, which, acting like a sponge, force out the fibrin from among them before the general mass of the blood is fully coagulated. Whether this explanation is correct or not, it is certain that the formation cannot occur at all without a previous disunion of the principal constituents of the fluid, thereby predisposing them to the event in question. To ascertain whether this tendency to the development of the buffy coat exists it is not necessary to make use of a spoliative bleeding, but simply to draw a few drops of blood, and to look at it with the microscope, which will at once detect the slightest deviation from the normal standard. The red corpuscles will be observed to run almost immediately into clusters of piles or rouleaux, as represented in fig. 1.

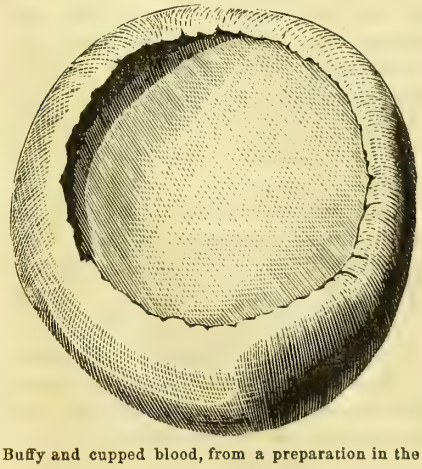
Fig. 1.



Microscopic diagram, showing the reticulated arrangement of the corpuscles in inflammatory blood. In the upper part, normal ordinary aggregation is shown in contrast. (Wharton Jones.)

In certain forms of inflammation and conditions of the system the blood is not only buffed, but cupped; that is, the upper surface of the crassamentum exhibits a hollow appearance, as if it had been scooped out with a knife. This occurrence usually denotes a higher degree of morbid action than the mere presence of naked fibrin on the top of the clot, and yet it is not unfrequently witnessed under circumstances which render it very questionable whether there is any inflammation at all, as in anemia, in profuse evacuations from the bowels, skin, and kidneys, in scurvy, and in chlorosis. It is generally not easy to

Fig. 2.



Buffy and cupped blood, from a preparation in the author's collection.

account for such anomalies, but of their practical import every practitioner must be fully aware. In my private collection is a beautiful specimen, which I obtained many years ago from bleeding a young man laboring under pleuro-pneumonia, in which both the buffed and cupped appearances exist in a marked degree on both surfaces of the crassamentum. The adjoining sketch (fig. 2) affords a good illustration of the preparation.

4. INTIMATE NATURE OF INFLAMMATION.

In the definition of inflammation, given in the early part of this chapter, no attempt was made to specify its true character or essential nature. To have done so would have been premature; but now that we have studied its various local phenomena and traced its constitutional effects, we are fully prepared to enter upon the subject, and to ask the question, What is inflammation?

To answer this question in an intelligible and satisfactory manner, it is necessary to consider, 1st, the nature of the capillary vessels, in which the morbid action is mainly carried on; 2dly, the character of the blood, which, as already seen, is so singularly changed in this affection; 3dly, the part played by the nervous system, or, perhaps, more properly speaking, by the nerves of the affected structures; and 4thly, the condition of the tissues at the seat of the disease.

The capillaries are those minute canals which are everywhere interposed between the arteries and veins, of which, in fact, they are only so many continuations. That their structure is similar to these vessels is analogically extremely probable, although it is doubtless somewhat modified to enable them to fulfil the various duties which nature has delegated to them, since they are not merely designed as channels for the transmission of the blood, but also as organs for the elaboration of various kinds of fluids, as those which nourish the system and those which are thrown off in the form of secretions. With regard to their caliber, these vessels are divisible into two classes. The one embraces those minute tubules which, though invisible to the naked eye, are found, when microscopically examined, to be capable of carrying a continuous stream of blood, so as to give the part in which they are situated a red appearance. The other group includes those delicate vessels, the cavity of which is so small as to admit only a single globule at a time, and which it is often difficult to detect even with a strong magnifier.

The blood, as it circulates through the body, and immediately after it has been drawn from a vein of the arm, has the appearance of a homogeneous fluid; but a careful examination shows it to consist of numerous component elements, intended for widely different purposes in the economy. Coagulation separates it into two parts, one of which is solid, and hence called the crassamentum; the other is fluid, and named the serum. The crassamentum consists of a pale, whitish, transparent fluid, known as the blood-liquor, plastic matter, plasma, or coagulating lymph, and of minute particles, globules, or corpuscles entangled in it and suspended by it as the blood is passing the rounds

of the circulation. The particles are of two kinds, the red and the colorless; the former, which have long been familiar to anatomists, and which impart to the crassamentum its red hue, are exceedingly abundant, and vary in size from the $\frac{1}{3000}$ to the $\frac{1}{3500}$ of an inch in diameter; they are of a flattened, globular shape, and their office seems to be to absorb oxygen from the atmosphere and to convey it to the different parts of the system, for the purpose of invigorating its several organs and tissues. The colorless or pale corpuscles have only been recently discovered; their number is very limited, except in certain forms of disease, when it is much increased; they are round, much larger than the red, and finely granulated on the surface, thus giving them a rough appearance. What the precise office of the white corpuscles is has not been determined, but it seems probable that it is connected, in some way, with the process of nutrition, which is also the case, only more certainly, with the blood-liquor, which is essentially associated with this operation.

In the vessels of the living body, the white globules seem to have no disposition to mingle with the red; on the contrary, they keep in close contact with the inner surface of the vessels, coasting, as it were, slowly along in the blood-liquor, outside of the general current. The red particles, on the other hand, pass quietly and gently along the centre of the vessels, regardless, so to speak, of the colorless, and in a much more rapid and lively manner, without any adhesion to each other, to the white particles, or to the coats of the containing vessels.

The essential elements of the inflammatory process, so far as we are able to comprehend them, are, 1st, slight contraction of the capillaries, with a retardation of the flow of blood; 2dly, dilatation of these vessels and an increased rapidity of the circulation; and, 3dly, a quiescent state of the capillaries with complete stagnation of their contents. While these changes are going on in the interior of these vessels, important changes are wrought in the blood, both in regard to its consistence, its color, the arrangement of its globules, and the character of the plasma. Finally, the coats of the vessels are themselves seriously altered, being rendered preternaturally soft and fragile, and therefore temporarily incapable of transmitting the vital fluid. These various changes are so important as to demand each separate consideration.

If a drop of rectified spirits, or any slight stimulus, be applied to a capillary vessel in the web of a frog's foot, or the wing of a bat, the effect will be to cause slight contraction of its caliber, with a partial arrest of its contents, the particles of blood moving to and fro for a few seconds, when they will be observed to regain their proper course, and to pass on as if nothing had occurred. If the irritation be more severe, as when a drop of capsicum is applied, the vessel, instead of diminishing, is instantly dilated, or, if there be any contraction, it is so slight and transient as to be inappreciable by the sight. However this may be, the dilatation soon becomes marked and decided, as is proved by the fact that the vessel now carries a much larger quantity of blood than in the natural state, the red particles being sent into it in increased numbers, as well as with increased force and velocity,

evidently in consonance with the augmented action of the heart, which, beating perhaps from ninety to one hundred and ten in the minute, throws the blood with extraordinary impetus into the inflamed part.

The inflammatory action advancing, the dilatation of the vessel steadily and regularly augments, until, at length, its tunics having been expanded to their utmost, the artery becomes a mere passive tube, palsied and crippled in its action, and therefore not only incapacitated for transmitting its contents, but for performing any of its more delicate functions as an organ of nutrition and secretion.

In the condition now described the capillary is not only distended to its utmost, but it is distinctly elongated and tortuous, sometimes almost knotty, as if it were affected with aneurismal enlargements, or real varices. Its coats are also preternaturally soft and lacerable, from intermolecular changes in their structure.

The blood, which is the immediate cause of this dilatation, is literally impacted in the vessel, pressing everywhere upon its sides, and thus causing, by degrees, complete remora, or stagnation. The white and red particles, instead of pursuing an orderly, quiet, and independent course, as in the natural state, are now observed to be more or less intermixed; and such is the manner in which they are crowded together, that both are materially changed in their shape, being irregularly flattened, elongated, and distorted, as well as adherent to each other and to the sides of the vessel. When there is complete stoppage, the distinction between the two sets of globules is entirely lost, the blood forming a stagnant pool, of a dark, homogeneous aspect.

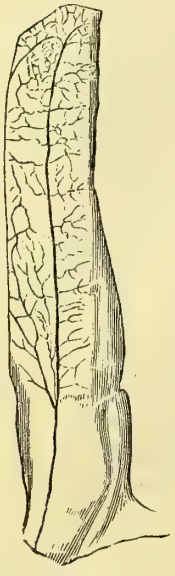
These various changes, which are brought about gradually, not suddenly, may be studied with great advantage in what occurs in inflammation of the conjunctiva. If this membrane be irritated, as, for example, by the contact of a foreign body, there will be an immediate rush of blood to the part, thus causing a great seeming increase of its vascularity. In a few minutes hundreds of vessels, previously invisible, will be seen shooting out in different directions, and connecting themselves with the sides of those that appeared in the first instance. These are not new channels, but old ones appertaining to the second class of capillaries, rendered evident by the intromission of red particles, which are either excluded in the healthy state, or which pass along in so slow and gradual a manner as to elude the eye of the observer.

It is not to be supposed that the globules of the blood, as they are sent by the heart into the irritated arteries, are able, all at once, to pass through them without any difficulty. Instead of this, after having proceeded a certain distance, they rebound against themselves and the sides of the vessels, so as to undergo a kind of oscillatory movement; but, gradually yielding to the force exerted upon them from behind, they are urged onward and onward until they reach the corresponding veins, into which, as their caliber is much larger than that of the arteries, they rush as into a vortex, and instantly disappear in the current beyond. A similar oscillatory movement of the globules of the blood is observed when the circulation is about to be re-established

after it has been completely arrested. Some time is required for the detachment of these bodies, and when they have finally succeeded in effecting this, instead of passing on at once into the corresponding vein, they are propelled forward and backward until the diseased arteries have become sufficiently dilated to admit of their escape.

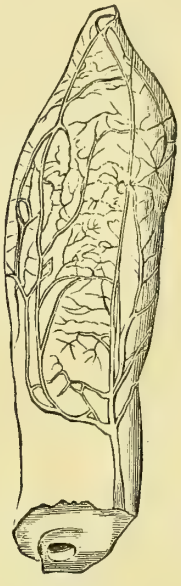
The dilated condition of the vessels is well seen in the accompanying cuts, representing the two ears of a rabbit, one in the natural state, and the other in a state of inflammation, from the application of cold. They were injected simultaneously, and consequently with the same degree of force, with size colored with vermilion. Fig. 3, is the natural ear; fig. 4, the inflamed one. The contrast is striking. The vessels of the latter are not only much larger and more tortuous than in the former, but also apparently much more numerous; the main artery in the one is likewise greatly increased in size, while in the other, namely, the natural one, it is quite small.

Fig. 3.



Natural ear of a rabbit.

Fig. 4.



Inflamed ear of a rabbit.

But it requires no experiments upon the inferior animals to prove the existence of increased vascularity in inflammation; the remarkable change in the color of the part is sufficient evidence of the fact, to say nothing of the circumstance that, if an incision be made into it, the blood will gush out in much larger quantity than from a similar cut in the corresponding healthy structure.

When the morbid action is fully established and very intense, without, however, there being as yet complete cessation of the circulation, the contents of the affected vessels not unfrequently break through their softened and lacerable walls, occasioning thus a real extravasation of blood, as seen in the accompanying sketch (fig. 5), representing a magnified portion of inflamed serous membrane. Sometimes, again, although rarely, the blood escapes from the vessels, and, forcing its way through the cellular tissue, forms new channels, through which it afterwards continues to circulate.

Fig. 5.



Extravasated blood in an inflamed serous membrane.

Immediately around the seat of the

greatest intensity of the morbid action, marked congestion exists, and the blood, consequently, passes along very slowly, and with difficulty. Beyond this point the phenomena are somewhat different; the excitement is less considerable, but still sufficient to cause active vascular determination; the blood moves in a continuous stream, and with extreme velocity, but unable, as it approaches the focus of the inflammation, to make its way through the stagnant tubes, it is sent onward through collateral channels, now for the first time fairly opened for its reception. Thus it will be seen that, while at the centre of the morbid action stagnation occurs, and around this a sluggish circulation prevails, an increased activity is going on in its neighborhood. The arteries leading to the affected part are distended, and pulsate strongly, but not, as some have asserted, with preternatural frequency.

The changes produced in inflammation are admirably depicted in the annexed sketch (fig. 6), from Bennett, representing a portion of the web in the foot of a young frog, after having been irritated by a

Fig. 6.



drop of strong alcohol; it is magnified two hundred diameters, and exhibits a deep-seated artery and vein, somewhat out of focus, with capillaries running over them, the whole being interspersed with pigment cells. On the left of the figure the circulation is in its normal state; at the centre it is retarded, the vessels are crowded with corpuscles, and the column of blood is oscillating; on the right there is deep congestion, with exudation: *a* represents the vein, occupied by dark blood, moving more slowly than in the artery, and running in the opposite direction; the lymph space on each side is filled with yellowish plasma, and contains a number of colorless corpuscles, some clinging to the sides of the vein, others moving tardily along; *b* represents the artery, with a rapid current, permitting nothing to be seen but a reddish-yellow broad streak, with lighter spaces at the sides. Opposite *c*, a vessel has given way, and caused an extravasation of blood, resembling a brownish-red pool. At *d*, there is complete congestion; the corpuscles are closely adherent to each other

and to the sides of the vessels, which they entirely fill, being one semi-transparent reddish mass. The intervascular spaces are abnormally thick and opaque, and occupied by exudation.

The part played by the nerves in inflammation is still very imperfectly understood. It is evident, however, that it is very important, although we are unable to define its character, or specify its degree. In traumatic inflammation, as well as in many cases of the idiopathic form of the malady, the primary impression is probably nearly always made upon the nerves, from which it is immediately reflected upon the capillary vessels, inducing, at first, contraction, and then dilatation, of their caliber, with a preternatural influx of blood, and, finally, an increase of color. The sensibility of the part being awakened, the heart is instantly roused into action, followed by serious disturbance of the circulation at the seat of the morbific impression, as if nature were making an effort to shake off the cause of the disease. It is this occurrence that generally gives the patient the first intimation of the impending mischief; the nerves, resenting the encroachment, apprise the brain, or cerebro-spinal axis, of the attack, and the consequence is that the heart, acting with unusual vigor, throws an undue quantity of blood into the suffering structures. If this explanation be correct, it follows, almost as a necessary sequence, that inflammation, instead of being, as has sometimes been imagined, a process of perverted nutrition, is in reality merely an attempt on the part of the affected tissues to rid themselves of some hurtful impression. All the rest of the process is easily understood; the discoloration, swelling, pain, heat, and disordered function, being merely so many links in the chain of morbid action.

As the inflammation increases in intensity, the nerves actively participate in the morbid process, their substance becoming injected, softened, compressed, and otherwise altered, in conformity with the peculiarity of their structure and function. The effect of such a change upon the welfare of the affected textures must be extremely pernicious, as it must materially diminish the nervous current, if not entirely arrest it, and thus weaken and prostrate the vital powers of the part.

The joint agency of the nervous and vascular systems, in the production and maintenance of inflammation, has been happily illustrated by the researches of modern physiologists. It has been ascertained, for example, that, when the ophthalmic branch of the fifth pair of nerves is divided in the cranial cavity of a rabbit at the Varolian bridge, inflammation is speedily lighted up in the surface of the eye, eventuating in opacity of the upper segment of the cornea. What is still more remarkable is, that, when the nerve is cut on the petrous portion of the temporal bone, so as to involve the destruction of the ganglion of Gasser, the resulting irritation is not only more violent in degree, but much more deeply seated, as well as more deplorable in its effects, the consequence being nothing less than a complete disorganization of the organ.

Analogous effects follow the division of the pneumogastric nerves. When these cords are cut high up in the neck, the lining membrane

of the air-passage assumes a dark color, the lungs are engorged with black blood, and an abundance of serosity is poured out into the parenchymatous texture, as well as into the pulmonary vesicles and the minute branches of the bronchiæ. The pleura generally participates in the irritation, and there is almost always more or less inflammation of the stomach, with a suspension of the secretion of the gastric juice.

Animals in which the brachial plexus of nerves has been tied are seized, in a short time, with inflammation of the integuments of the remote parts of the limb, which gradually progresses until all the soft structures are invaded by gangrene. A friend of mine removed a section of the peroneal nerve on account of a neuroma; the wound was long in healing, and two of the small toes sloughed before the patient recovered. These facts enable us to explain certain circumstances that have long been noticed by practitioners in particular morbid states of the system. A part affected, for instance, with palsy is much less capable of withstanding the ordinary impressions of physical agents than one receiving its customary supply of nervous influence. A burn in a paralytic person creates much more serious mischief than in one that enjoys perfect health; and the same is true in regard to blisters and other irritants, the injudicious application of which often leads to the destruction of large portions of the skin and subjacent cellular tissue. There is little doubt that the inflammation of the bladder, which always supervenes upon serious injury of the spinal marrow, is caused in the same way; that is, by the interruption of the natural supply of the nervous influence.

In whatever manner parts are deprived of their nervous influence, it is presumable that they are brought under relations somewhat analogous to those of a frozen limb. The temperature is lowered, the sensibility impaired, the process of nutrition perverted; in a word, the natural connection between the vessels and nerves is broken up, and hence that series of phenomena known under the name of inflammation.

The tissues at the seat of the inflammation, considered apart from the vessels and nerves which are distributed through them, and which, as has been seen, play such an important part in the morbid process, are variously altered, becoming not only the recipients of various deposits, but experiencing, especially in the advanced stages of the disease, marked softening, and sometimes also fatty degeneration, the latter being more particularly liable to occur when the morbid action is tardy in its movements, and rather below the ordinary acute standard. The principal deposits are serum and lymph, either alone or in union with pus and blood. When these products are very abundant, there will necessarily be much swelling, and the consistence of the parts will be soft or hard, according to the structure of the affected tissues and the nature of the effusions.

A careful study of the inflammatory process leads to the conviction that, in its earlier stages, it is one of increased action, both of the capillary vessels and of the tissues through which these vessels pass, and of which, consequently, they form a most important integral part.

Microscopical and clinical observations clearly prove the truth of this statement. Subsequently, however, when the disease is fully established, when the vessels are crowded to excess with blood, and when this fluid manifests a tendency to stagnation, or when stagnation has actually occurred, there is every evidence of decided debility. The capillaries are now partially paralyzed, and distended to the utmost with non-oxygenated blood; the different tissues are surcharged with inflammatory products; nutrition, secretion, and absorption, are interrupted, or completely suspended; in short, everything is indicative of enfeeblement and prostration.

Much discrepancy exists among writers and teachers in regard to what constitutes inflammation; some, among whom I include myself, believing that but a slight degree of action is necessary, while others maintain that the departure from the healthy standard must be very great. Thus, Dr. Miller, Professor of Surgery in the University of Edinburgh, declares that true inflammation, properly so called, is always attended with suppuration; apparently forgetting that thousands of human beings daily die from this affection, long before it has attained this crisis. Dr. John H. Bennet, another eminent Scotch professor, makes fibrinous exudation the indispensable condition of the process; and he goes so far even as to propose the word exudation as a substitute for that of inflammation. For myself, I cannot see that such a change of nomenclature would have any other effect than that of confusing the mind of the student; the term is ill chosen, and cannot, therefore, advantageously replace one which, although merely conventional, is yet sufficiently expressive for practical purposes. But there is still a more serious objection to the adoption of this word, and that is, that it does not convey a correct idea of the nature and extent of the morbid process. Dr. Bennet, and those who think and reason with him on the subject, must be aware that there are inflammations of certain organs and tissues in which the morbid action is so great as to destroy life, and yet the most careful examination, microscopical and chemical, fails to detect the existence of fibrin in the affected structures. It is only necessary to instance the arachnoid membrane, the aponeuroses, cartilages, and nerves, in which this disease is often, if not generally, unattended by a deposition of fibrin. But while it is certain that inflammation is frequently present, and that, too, to a serious extent, without fibrinous exudation, it is equally true that this substance is usually poured out in this disease, especially if it has already made considerable progress. Much will necessarily depend upon the nature of the affected organs and tissues, some furnishing plasma much more readily, and in much greater quantity, than others. Moreover, it requires very nice judgment, particularly in the living subject, to define the boundaries between congestion and inflammation, or to determine where the one terminates and the other begins. Inflammation, in its inceptive stages, may be compared to a latent or smothered fire, kept in abeyance by a redundancy of surrounding material interfering with its development; exudation cannot occur all at once; some time is necessary to prepare the vessels for their new office: so it is with the flame in the furnace; it

does not break forth immediately on the application of the kindling, and yet no one would say that fire was not actually present. Most of the disputes that have grown out of this question have arisen from a misunderstanding on the part of observers as to the amount of disease, or change in the affected part, necessary to constitute inflammation; and it is obvious that there never can be any fixed or settled views upon the subject so long as this is the case; nor can the question be satisfactorily disposed of, unless it be studied with reference to the nature and functions of the different organs and tissues of the body; or, if I may use the expression, the conduct and habits of the organs and tissues in their healthy and morbid relations.

Another source of difficulty, in the settlement of this question, is the fact that many pathologists are seemingly incapable of divesting themselves of the idea that inflammation must necessarily be treated by depletion, particularly the abstraction of blood by the lancet and leeches, purgatives and starvation. It is apparently impossible for them to disconnect the two things, and yet it requires but little reflection, and certainly no great amount of experience, to show the erroneousness of such a conclusion. Cases of inflammation are daily met with in practice which imperatively demand the use of stimulants from their very commencement, cases which, if treated in any other manner, would have a most unfavorable termination; and it is not going too far to assert that there is a period in almost every instance of the disease, if at all severe, or occupying an important part of the body, in which the patient will not be greatly benefited by the use of brandy, wine, and quinine, along with nutritious food.

5. TREATMENT OF INFLAMMATION.

Having considered the symptoms, seat, and nature of inflammation, I shall proceed, in the next place, to speak of its treatment. In discussing this branch of the subject, we shall find occasion to congratulate ourselves upon the numerous and diversified means which are at our command for the purpose of combating morbid action, as well as upon the various displays of the system for averting evil and promoting good.

Two leading indications present themselves in every case of inflammation when sufficiently grave to demand the attention of the practitioner. The first is the removal of the exciting cause of the disease, and the second the establishment of resolution.

In regard to the first of these points, it is obvious that, although the disease may be modified in its character, or rendered comparatively harmless, by treatment, yet it will be impossible to arrest it completely so long as the exciting cause is operative. Thus, for example, in strangulation of the bowel, it would be folly to expect to establish resolution of the inflammation which the strangulation has produced without the removal of the stricture which is the cause of the morbid action. In such a case, one of two things must happen, either the sufferer must die from the effects of the disease, or he must be relieved by the knife, or by nature's operation, namely, the formation

of an artificial anus. An inflammation of the lungs from the presence of a foreign body in the air-passages cannot be effectually cured so long as the foreign body remains, and keeps up the morbid action. The same thing is true in relation to inflammation of the bladder produced by hypertrophy of the prostate gland. The gland, acting obstructingly to the flow of urine, is the cause of the cystitis, and just so long as the cause remains will the disease continue, although, as remarked above, it may be materially modified by our therapeutic measures. But it does not follow, on the other hand, that the inflammation shall at once subside because the cause which produced it has been removed. The malady may have already made so much progress as to render the restoration of the part either impracticable, or possible only after a long time and after much suffering. In our attempts to get rid of the exciting cause, by mechanical means, it is hardly possible to exercise too much care and gentleness, or to institute them too early. All officious interference, rude probing, or rough manipulation, must be carefully avoided, lest we add, as it were, fuel to the flame, aggravating and perpetuating the disease. Splinters, nails, needles, pieces of bone, are gently extracted with the finger and forceps; the calculus is cut out of the bladder; the speck of steel is picked from the cornea; and the aching tooth is lifted from its socket; all in as gentle and easy a manner as possible.

It is not always, however, that the exciting cause of the malady can be detected, even if we avail ourselves of all the lights that have been furnished us by modern research. Very frequently the cause is latent, the morbid action having, to use a very common but unphilosophical expression, arisen spontaneously. Such an occurrence is, of course, impossible; there is always a cause for every disease, though it is not always in our power to discover it; and hence to wait for its removal before we begin our treatment might sadly endanger both part and patient.

The second indication is to establish resolution, or to disperse the morbid action, with the least possible detriment to the structures and functions of the diseased parts. To effect this, various remedies may be necessary, some being addressed to the general system, others directly to the affected parts; circumstances which have given rise to the division of the treatment of inflammation into constitutional and local.

I. Constitutional Treatment.—The constitutional treatment of inflammation consists of bloodletting, cathartics, emetics, depressants, mercurials, diaphoretics, diuretics, anodynes, and the antiphlogistic regimen. It must not be supposed, however, that all these means, or even a majority of them, are necessary in every case of this disease; so far from this being true, the morbid action often disappears spontaneously, or under the mildest and simplest remedies. Whenever constitutional treatment is demanded, it should be employed as early as possible, and with a determined hand, in the hope of being able to arrest the inflammation while it is yet in its inception, and, consequently, before it has made any serious inroad upon the part and system. A few doses of medicine, judiciously administered at the

outbreak of the disease, often do more good than twenty administered after it has attained its full development.

1. *Bleeding.*—General bleeding may justly be regarded as standing at the very head of the list of the constitutional remedies for inflammation, as it is at once the most speedy and the most efficient means of relief. The blood is usually drawn from one of the larger veins, and is permitted to flow until a decided impression has been made upon the system. When we consider the singular changes which this fluid undergoes in inflammation, the fact that it is sent in an unusually large quantity to the affected parts, and the circumstance that it is mainly instrumental in supporting the powers of the heart, it will not be difficult to form a correct idea of the importance of this operation, or the influence which it exerts in combating morbid action. Its value was not over-estimated by the older writers when they designated it as the *summum remedium* in the treatment of inflammation; yet, strange to say, bloodletting, notwithstanding the high rank which it has always occupied, as an antiphlogistic agent, has, of late, fallen very much into disrepute, particularly on this side of the Atlantic, where it had at one time so many advocates. A great change has come over the profession, in this respect, within the last fifteen years, and is steadily gaining ground, subverting all our preconceived notions upon the subject, and rendering it very questionable, in the opinion of many, whether bloodletting is really ever required as an antiphlogistic. Whether this change has been the result of a modification of the type of disease, of a more improved method of treatment with other remedies, or simply of the whim and caprice of a few prominent and influential practitioners, from whom the rest of the profession have imbibed their views, I am unable to assert, but the fact does not admit of a doubt that more quarts of blood were formerly spilt than ounces are spilt now. Bleeding is no longer the fashion; the operation is denounced by every one. Public sentiment has got to an extreme upon the subject, and we may therefore soon look for a reaction in favor of the opposite opinion. For myself, I cannot but regret this state of things, because I feel satisfied that it does not rest upon a just and proper basis. If we formerly bled too much, too frequently, too copiously, and too indiscriminately, it is equally certain, at least to my mind, that the operation is not often enough resorted to at the present day. Many a deformed limb, blind eye, enlarged spleen, and crippled lung bear testimony, in every community, to the justice of this remark.

General bleeding is employed with different views. In the first place, it diminishes plethora; secondly, it changes the qualities of the blood, or, more correctly speaking, it places it in a better condition for resisting the effects of inflammation; thirdly, it weakens the powers of the heart and nervous system, and, consequently, the momentum of the circulation; and, lastly, it promotes the action of other remedies.

To obtain these effects in the most prompt and thorough manner, the blood should be taken from a large orifice in a large vein, the fluid running in a bold, full stream to the amount of at least three

ounces in the minute, the patient being either seated upon a chair or standing up at the time. If the operation is performed while the patient is recumbent, a much larger quantity will be required to be drawn before the system and part become sensible of the loss. When the object of the bleeding is merely spoliative, or intended to rob the vessels of an unusual amount of their contents, it may be done in this way; but even then the better plan will be to bleed in the semi-erect position, reopening the vein a second and even a third time, if premature syncope should take place to interfere with the requisite abstraction. The difference in the effect of these two methods of bleeding is forcibly exemplified in conjunctivitis. The patient who is bled in the erect position soon begins to feel faint, and to experience relief from pain, the eye at the same time exhibiting a blanched appearance, instead of the scarlet hue which it had a moment before; whereas the one who is bled in the recumbent position will retain his strength for a much longer time, and when, at length, he is rendered unconscious, the inflamed surface will be found to be still comparatively discolored. The impression, moreover, will generally be much more permanent in the former than in the latter, and the return, consequently, of the capillary injection more slow and less perfect.

The circumstances which call for this operation are generally considered to be a hard, strong, full, and frequent pulse, a plethoric state of the system, and great intensity of morbid action. When such a conjunction exists, the surgeon cannot possibly go amiss in regard to the abstraction of blood, constitutionally considered. He may, perhaps, it is true, combat the disease without such recourse; by the use of antimony, purgatives, and other means, he may gradually bring down inordinate excitement, and thus afford the affected structures an opportunity of throwing off the burden with which they are oppressed; but if he wishes to make a prompt and decided impression, spoliative and depressive, upon the system and part, he can accomplish his object much more readily and effectually with the lancet than with any other remedy in the whole catalogue of antiphlogistics. If nauseants depress the heart's action equally with the lancet, they certainly do not produce the same effect in unloading the engorged capillaries at the seat of the inflammation, in restoring the circulation, and in reclaiming morbid structure. The operation of the one is gradual, and, at times, almost imperceptible; of the other, prompt and decisive, often cutting down the disease with a single blow; or, at all events, leaving it in a condition to be afterwards easily dealt with by other and more simple means.

The quantity of blood drawn at a single operation must vary according to circumstances, the object being effect, and not ounces; for what would be a large bleeding for one person might be a small one for another. From sixteen to twenty ounces is a good average loss. Some individuals faint almost as soon as the blood begins to flow, while others can scarcely be made to faint, no matter how they are bled, or how much blood is drawn. The best plan, therefore, always is to continue the operation until it has made a decided impression both upon the nervous and vascular systems, avoiding actual

syncope, but inviting an approach to it, and then guarding against the danger of excessive reaction.

We now and then hear of enormous quantities of blood being removed for the cure of inflammation. The Memoirs of the French Academy furnish us with instances where three hundred ounces were abstracted within a week; and equally remarkable examples are recorded among British writers. Dr. Francis, of New York, while laboring under a violent attack of croup and tonsillitis, was bled to the extent of nearly two gallons and a half in a few days. Such cases are remarkable as showing the wonderful power of endurance of the system, but they are not to be held up as examples for the imitation of the practitioner. It must be understood, however, that inflammation often engenders a tolerance of bleeding. Thus, a nervous person who in the healthy state will faint from the loss of a few ounces of blood, will, when laboring under severe inflammation, bear with impunity the loss of perhaps ten times that amount. A similar tolerance of remedies is frequently established by disease. In delirium tremens, opium may be given in doses that would destroy half a dozen healthy persons; in pneumonia, the stomach acquires an extraordinary degree of tolerance for tartar emetic; and in certain forms of syphilis mercury may be given in large quantities without salivation, the system being seemingly insusceptible of its influence.

The first effect of a loss of blood upon the system is a sense of muscular debility. Presently, the individual begins to look pale, to see indistinctly, to have a confusion of ideas, to perceive noises in his ears, and to feel light in the head. If the flow be not immediately stopped, he will next become deadly sick at the stomach, convulsive tremors will pervade his limbs, the pallor of the countenance will increase to a deadly white, the respiration and pulse will nearly cease, and, if he is not supported, he will fall down in a state of unconsciousness. He has fainted. Such an effect is sometimes produced by the loss of a drachm of blood; at other times not until many ounces have been drawn.

To recover a person from this condition, he must be immediately placed in the recumbent position, cold water dashed upon the face, and a free access of air obtained by throwing open the doors and windows of the apartment, aided, if necessary, by the fan. If he is slow in regaining his consciousness, the body is raised a little higher than the head, hartshorn is held near, not to, the nose, and sinapisms are applied to the extremities and the precordial region. Sometimes a draught of cold water will do more in reviving the patient than anything else. If, from idiosyncrasy or excessive loss of blood, the syncope assumes an alarming character, a stimulating enema is used, and mustard applied along the spine; but no stimulants are given by the mouth, unless it is certain that there is still some power of deglutition.

The reaction which succeeds the stage of depression is characterized by a gradual return of the various functions of the body to their natural condition. Color reappears upon the cheeks, the heart and lungs act with more energy, the limbs regain their warmth, the sur-

face often becomes slightly moist, and the mind recovers from its confusion. The only treatment necessary, during this stage, is proper vigilance, lest the reaction should become too vigorous; depression being rather favored, when the morbid action is at all severe, than rapidly relieved.

When the loss of blood has been disproportionably great to the powers of the system, the stage of depression may be succeeded by death, or reaction may at length occur, the struggle for many hours, perhaps, being one of life and death. This state may be induced by one copious bleeding, or by several small ones, establishing an undue drain upon the vital current. It is characterized by unusual pallor of the countenance, feeble pulse and respiration, coldness of the extremities, clammy perspiration, frequent sighing, great thirst and restlessness, vigilance, and a tendency to delirium. While the system is in this condition, local congestion, followed by inflammation, is not uncommon, the organs which are most prone to suffer being the brain, the arachnoid membrane, and the lungs. Sometimes the symptoms here described are mixed up with those of feeble reaction, and the countenance, perhaps, is flushed, the eye and ear are intolerant of light and noise, the respiration is quickened, the skin is hot and dry, and the pulse is thready, hard, and frequent. The proper treatment does not vary essentially in the two cases, our main reliance being upon opiates in full doses, milk punch, ammonia, and quinine, with elevation of the head and cold applications, exclusion of light and noise, and blisters, if there is marked tendency to local determination. Further bleeding would only cause further sinking.

In the abstraction of blood various circumstances are to be taken into consideration, among which the most important are the age, temperament and habit of the patient, the character and progress of the disease, the structure and functions of the affected organ, and the peculiar constitution of the atmosphere.

As a general rule, young and robust individuals bear bleeding much better than children and aged persons, who often experience great exhaustion from the loss even of a few ounces. Old subjects, in particular, are prone to suffer in this way, the system being often a long time in reacting, while in not a few instances the operation is followed by sinking. Infants and children are also slow in recovering from the effects of bleeding, but reaction having taken place there is much less danger of ultimate exhaustion. Persons of a nervous temperament are less tolerant of the loss of blood than the sanguine and bilious. Corpulent persons are bad subjects for the lancet, and the habitually intemperate are often thrown into delirium tremens by it. The inhabitants of densely crowded cities do not bear the loss of blood nearly as well as people residing in the country. In epidemics, as erysipelas, scarlatina, smallpox, measles, and puerperal fever, bleeding in any form is generally inadmissible. Finally, the abstraction of blood must be practised with the greatest circumspection in all cases of inflammation likely to be at all protracted, and in all persons suffering under grave accidents, as fractures, dislocations, and lacerated wounds, attended with danger of excessive drainage and hectic irritation. After

operations and injuries, excessive loss of blood may seriously interfere with the restorative principle.

The more violent the inflammation is, the more reason will there be, other things being equal, for early and active bleeding; so also if the organ affected be one highly essential to life. Blood is seldom taken when the inflammation is inconsequential as it respects its degree and seat, milder means generally sufficing for its subjugation.

In regard to the repetition of the bleeding, the practitioner must be governed, first, by the intensity and persistence of the morbid action; secondly, by the importance of the organ attacked; and, lastly, by the state of the blood. The disease continuing with little or no mitigation, there will be the same reason for bleeding that there was in the first instance, and the last may now, perhaps, be borne much better, the previous abstraction having, it may be, engendered a certain degree of tolerance. Intensity of action will be an additional reason for the act. The importance of the organ attacked must not be overlooked. An inflamed lung requires more energetic measures than an inflamed skin, and an inflamed skin than an inflamed finger. As it respects the buffy coat of the blood, its value as a sign of the necessity of a repetition of the operation has already been pointed out, and need not, therefore, be again discussed here. Associated with a persistence of diseased action, and a vigorous state of the circulation, it is of some practical importance, but much less than was at one time supposed.

2. *Cathartics.*—Cathartics constitute a most important class of remedies in the treatment of inflammation, being even more valuable than bleeding, because of their almost universal applicability. Their exhibition, however, should always be premised by the abstraction of blood, provided the nature of the case is such as to admit of it. Where this is contra-indicated, they may be given at once, and there are few diseases which fall under the province of the surgeon in which they will not prove eminently beneficial. They are usually divided into purgatives and laxatives, which differ from each other merely in the one being more active than the other. The distinction, however, is not without its importance in a practical sense.

Cathartics, considered as antiphlogistic agents, are employed for different purposes. In the first place, they may be administered simply to evacuate the bowels; secondly, to deplete the mucous membrane, and thus diminish the quantity of blood in the system; thirdly, to excite the action of the liver and mucous follicles; fourthly, to produce a revulsive effect, or to set up a new action at a distance from the original one; and, finally, to stimulate the absorbents, thereby inducing them to remove inflammatory deposits.

The importance of exhibiting cathartics as mere evacuants cannot be too strongly insisted upon when we consider that an overloaded state of the bowels is one of the most fertile sources of disease. Many of the so-called idiopathic inflammations evidently owe their origin to this cause, as is proved by the fact that a dose of active purgative medicine often promptly removes them, especially if administered at the commencement of the attack. An incipient ophthalmia, tonsillitis, or

fever, is frequently cut short in a few hours simply by clearing out the contents of the bowels, and getting rid of irritating fecal matter and vitiated secretions. Besides, as long as the bowels are constipated, it is impossible for other remedies to produce their specific effect, or for the various secretions to recover their natural tone.

Secondly, this class of remedies proves useful in depleting the bowels, by abstracting the serous portions of the blood from the vessels of the mucous membrane, and thereby diminishing the quantity of fluid in the general system. This practice is often beneficially adopted in inflammation of the large intestine, in what is termed dysentery, and in the milder forms of inflammation in various parts of the body, where the loss of the red particles of the blood is of questionable propriety. An ounce of Epsom salts, or half a pint of citrate of magnesia, will often bring away from eight to twelve ounces of serum from the bowels in the course of a few hours, with the greatest advantage as it respects the morbid action.

Cathartics may be given, in the third place, with a view to stimulate the liver, pancreas, and mucous follicles of the bowels. There are few inflammations, or diseases of any kind, in which disorder of the liver does not play a conspicuous part, either in exciting or maintaining the morbid action. The quantity of fluid poured out by this organ, in a state of health, in the twenty-four hours amounts to many ounces, and it is, therefore, not difficult to form a tolerably correct idea of the ill effects that must result from the interruption, modification, or complete suspension of its functions. The irritating material which it is destined to eliminate being retained in the blood, there must arise, as a necessary consequence, serious derangement of the nervous and vascular systems, as denoted by the excessive lassitude, headache, excited pulse, and other symptoms, so conspicuous in disordered states of the liver. But a diminished supply of bile is not the only difficulty; on the contrary, the fluid may be secreted in unnatural quantity, and yet, being vitiated in quality, the effects will hardly be less obvious. The pancreas, too, may have its functions deranged, which the well directed cathartic may readily restore to their normal condition. Of the vast influence exercised upon the health by the mucous follicles of the alimentary canal, it is hardly possible to form an adequate conception. Existing, as they do, everywhere in vast numbers upon the mucous surface, the suppression of their functions, even for a short time, cannot fail to be followed by local inflammation in different parts of the body, or the material aggravation of it, if it has been already lighted up. Hence, remedies calculated to restore, modify, or improve the secretions of these several structures constitute important objects of treatment, not only as preventives, but as means of cure.

Fourthly, the administration of cathartics proves useful in another way, namely, on the principle of revulsion, metastasis, or counter-irritation, by establishing a new action in a part more or less remote from that originally affected. During the action of a brisk purgative, as well as for some time after, a larger amount of blood flows to the alimentary canal than is natural to it, and the consequence is that the

suffering organ is temporarily relieved of vascular turgescence, on the principle that two morbid processes cannot go on, to any extent, at the same time. This action may be intermittent or permanent, according to the character of the cathartic and the mode in which it is exhibited. In inflammation of the head, throat, and, in fact, of the supra-diaphragmatic portions of the body generally, this principle is never, for a moment, lost sight of by the practitioner, constituting, as it does, a most important element of treatment.

Finally, cathartics, by clearing out the alimentary canal, and restoring the secretions, pave the way for the more successful action of other remedies, as diaphoretics, anodynes, diuretics, and sorbefacients. They exert, in this respect, very much the same influence, only in a slighter degree, as venesection and leeching, diminishing the volume of the circulating mass, and diverting the blood from the suffering organ. Removing obstruction, restoring secretion, and establishing new action, they enable the absorbent vessels to recover from their torpor, and to render themselves useful in removing inflammatory deposits.

Cathartics are particularly valuable in inflammations of the brain and its membranes, of the eye and ear, the throat, respiratory organs, the liver, skin, and joints. In gastritis, enteritis, peritonitis, cystitis, wounds of the intestine, and strangulated hernia, they are either contra-indicated, or exhibited with the greatest possible circumspection, and only in the mildest forms. In most, if not in all, of these affections, the best purgative is the lancet, aided by large anodynes, either alone or in union with calomel. Tranquillity, not perturbation, is what is sought to be attained under such circumstances, on the principle that whatever excites peristaltic action must prove prejudicial to the inflamed surface.

Cathartic medicines must not be exhibited merely with a view to the correction of disordered alvine evacuation. Such a procedure could not fail to prove injurious. The action of these remedies is perturbating, and therefore subversive of healthy function; hence, it would be folly to expect that the passages should be entirely natural so long as they are exhibited. The more frequently they are given the more likely will this be the case.

When these medicines are tardy in their action, their operation may be aided by injections; and cases occasionally occur where the latter remedies may advantageously, and entirely, take the place of the former.

The number of purgatives and laxatives is very great, and the surgeon may therefore give himself considerable latitude in the choice of his articles. A few, however, either alone, or judiciously combined, will answer his purpose in nearly every case that may come under his observation. Where a merely evacuant effect is desired, nothing is better than a dose of castor oil, rhubarb, or jalap; the saline cathartics produce watery passages; calomel, blue mass, and gray powder act specifically upon the liver; and where an irritating, revulsive, or metastatic effect is wished for, the proper articles are compound extract of colocynth, scammony, gamboge, and aloes. In external inflamma-

tions, as well as in inflammations of the supra-diaphragmatic organs generally, one of the most useful cathartics, as I have found from long experience, is an infusion of senna, or of senna and Epsom salts. It operates not only promptly and powerfully upon the bowels, but also upon the liver, stimulating this organ to increased action, and proving itself hardly inferior, in this respect, to calomel and blue mass. The only objection to it is that it is apt to gripe, but this tendency may usually be effectually counteracted by combining with it some carminative. Croton oil is rarely used, except to relieve obstinate constipation. It will hardly be necessary to say that the greatest caution is required in its administration.

Injections, clysters, or enemas may be prepared of various articles, as gruel and common salt, water and mustard, castor oil, spirits of turpentine, infusion of senna, jalap, and other substances, according to the intended effect. Whatever material be used, the important rule is to mix with it a sufficient quantity of fluid, warm or cold, to distend the lower bowel. It may be administered, as I usually prefer, with a common pewter syringe, having a long nozzle, and capable of holding at least from sixteen to twenty ounces; or, where there is obstinate constipation, with an ordinary stomach tube. Recently an excellent enema-syringe has been manufactured of gum-elastic, of the same shape as the old metallic one, only much superior in its mode of action, and much more easily kept in repair. Whatever instrument be employed, care must be taken that the patient be placed upon his side or belly during its introduction, and also that he be properly held, for fear of accident, especially if he be delirious or otherwise unmanageable. Professor Pope, of St. Louis, published, some years ago, the particulars of a case of a child that perished from perforation of the rectum during the administration of an enema.

3. *Mercury.*—The reputation of mercury, as an antiphlogistic, has long been established. Although the precise mode of its action is still imperfectly known, its beneficial effects are well understood. Its virtue in controlling inflammation is hardly inferior to that of the lancet and of tartar emetic, while, during the decline of the disease, as a powerful sorbefacient, or promoter of the removal of morbid deposits, it is without a rival in the materia medica. It may, therefore, be given during the height of the malady with a view of arresting its progress, and subsequently, after this object has been accomplished, for the purpose of getting rid of effused fluids, or reclaiming oppressed and disorganized structure. The efficacy of the remedy, in both these relations, is particularly conspicuous in the phlegmasias of the fibrous and fibro-serous tissues, in gout and rheumatism, synovitis, carditis, arteritis, hepatitis, splenitis, pneumonia, laryngitis, iritis, orchitis, osteitis, and in syphilis. It is less apparent, though not without its value, in inflammation of the brain, the skin, and mucous membranes, bronchitis, nephritis, cystitis, and metritis.

It is rarely that the treatment of inflammation is commenced with the exhibition of mercury. It is only in very urgent or neglected cases that this rule is departed from, its potency and activity being

always augmented by previous depletion. Whenever, therefore, there is evidence of plethora, bleeding and purgation should precede its use. There is a mercurial point, so to speak, in inflammatory affections, prior to which the employment of this remedy either proves positively injurious, or greatly disappoints expectation. This point is characterized by softness of the pulse, a relaxed condition of the skin, moisture of the tongue, and a general tendency to restoration of the secretions. Administered during the height of the morbid action, when the whole system is enveloped, as it were, in flame, it can hardly fail to act as an irritant, and to increase the general excitement. For want of attention to this rule, a great deal of mischief is often done, and a remedy, otherwise of inestimable value, permitted to fall into disrepute.

Of the manner in which mercury acts in relieving inflammation we have, as already intimated, no very definite information. That it affords powerful aid in controlling the action of the heart and vessels, both large and capillary, is unquestionable, but how this effect is produced, whether by any direct sedative impression it may exert, or by merely correcting the secretions, is a point concerning which our knowledge is entirely at fault. Nor is our information any more reliable in regard to the changes which mercury induces in the state of the blood. We know very well how greatly the properties of this fluid are modified by inflammation, what increase there is of fibrin and white globules, and how promptly, in many cases, these changes are corrected by the judicious use of mercury; but in what manner this is effected is, in the present state of the science, altogether inexplicable. The therapeutist may speculate about these things as much as he pleases; he may invent theory after theory, and entertain us with the most elaborate and ingenious arguments, and yet he will utterly fail to throw any real and substantial light upon them. In a matter so abstruse as this experience alone can guide us, and this ought surely, for all practical purposes, to be sufficient.

During the decline of inflammation, and, indeed, in many cases long after the morbid action has been completely checked, the exhibition of mercury is of the greatest advantage in effecting riddance of the morbid products. Of the manner in which this is done we have occasionally direct ocular demonstration in some of the external phlegmasias. Thus, in iritis, if the system be placed under the influence of mercury, the effects of the remedy are rendered obvious by the daily progress which the affected structures make in freeing themselves of the plastic matter that was effused during the height of the inflammation, and which frequently proves so destructive to them by the changes which it induces in the pupil. Similar effects are witnessed in inflammation of the cornea, attended with interstitial deposits. The opacities which result from these deposits often vanish in a short time under the influence of slight ptyalism, the effect being frequently apparent before the action of the medicine is fairly developed. In orchitis, after the disease has measurably subsided, the swelling and induration in general promptly disappear under the use of mercurials, aided by rest, light diet, and purgatives. In all these, and similar cases, the benefi-

cial effects of the agent are evidently due to its sorbefacient properties, or to the manner in which it stimulates the absorbent vessels, compelling them to remove the products left by the previous action.

Administered merely as a sorbefacient, the effects of this remedy are often insensible, its action being exerted in a very slow and gradual manner, yet hardly any the less efficiently. This kind of action is particularly desirable in chronic diseases, attended with a crippled condition of the tissues from semi-organized deposits, and an enfeebled state of the general system. Under such circumstances, active mercurialization is altogether inadmissible, from its irritating and prostrating effects; while a more gentle and persistent course is often followed by the greatest benefit, the gums being merely touched, or rendered slightly red, tumid, and tender, as an evidence of the silent operation of the remedy.

The best form of exhibition of the remedy is calomel, blue mass, or mercury with chalk. Where a prompt and powerful impression is desired, as when there is high inflammatory action, likely to prove speedily overwhelming in its effects, not only threatening structure but life, the medicine should be given in large and frequently repeated doses, so as to keep up a decided and well-sustained influence. For this purpose the best article is calomel, in doses of from three to five grains, administered every three, six, or eight hours, until we have attained the object of its exhibition. When the case is at all urgent, as, for example, in croup, pneumonia, or carditis, no time is to be lost; whatever is done must be done quickly, with a bold, vigorous hand, and a determined mind; the remedy must be given in full, not in small, insufficient quantities, or in a faltering, hesitating manner. There is but a short step between the disease and the grave, the struggle is one of life and death, and the victory must be accomplished, if accomplished at all, at all hazard, present or future. When the disease is less violent, or the organ involved less important to life, the medicine is exhibited in smaller doses, and at longer intervals, and then, too, instead of calomel, the milder forms may be used, as blue mass or the gray powder. Where a chronic or insensible impression is desired, the bichloride may be given instead of calomel or blue mass, or the latter may be employed in smaller doses. Other forms of mercury, to be mentioned hereafter, as the protoiodide, cyanuret, and deutophosphate, are often beneficially prescribed in chronic disease of the skin, in glandular enlargements, in chronic affections of the joints, and in tertiary syphilis. Mercury with chalk, or gray powder, is a great favorite with some practitioners in inflammatory diseases of children and aged persons; but I now rarely use it in any case, having frequently found it to be nauseating, and generally too uncertain to be worthy of reliance.

To prevent the mercurial from running off by the bowels, it is usually necessary to combine with it a certain quantity of opium, as a fourth of a grain, half a grain, or even more, with each dose, according to the exigencies of each particular case. In children, and in all cases affecting the brain, opium should be given with great caution, especially during the violence of the morbid action. When the

skin is hot and dry, the mercurial should either be entirely withheld until further depletion has been accomplished, or it should be combined with some diaphoretic, as tartar emetic, ipecacuanha, or Dover's powder. Griping, which is so liable to occur during the progress of the treatment, should be counteracted by carminatives and the use of laxatives, as oil, salts, or magnesia.

It need hardly be said that the administration of so potent a remedy as mercury should be most faithfully watched. No honest or judicious practitioner uses it heedlessly or sakelessly. He knows that it is a remedy for good or for evil, and he therefore employs it wisely and properly; opportunely, not out of time. As soon as he discovers, by the fetid state of the breath, the red and tumid appearance of the gums, the metallic taste, and the increased flow of saliva, that the object of its exhibition has been attained, he either omits it altogether, or gives it only in very small quantity, and at long intervals. He does not persist in its administration, as was the custom with our silly forefathers, until the tongue is too big for the mouth, the teeth drop from their sockets, articulation, deglutition, and even breathing, are almost impossible, and the countenance presents a distorted and hideous aspect; but he simply touches the gums, maintaining the impression thus made, if necessary, on account of the continuance of the morbid action, or letting it die out, if the disease has been arrested.

There are certain individuals who, in consequence of idiosyncrasy, or the former use of mercury, cannot take this medicine, even in the smallest quantity, without being violently salivated. To avoid such an occurrence, which is always exceedingly disagreeable both to patient and practitioner, inquiry should always be made with a view to the ascertainment of this fact, in every case, previous to the administration of the medicine. On the other hand, there are persons who cannot be constitutionally impressed with mercury, however largely it may be used, under any circumstances. They are completely mercury proof. It fails to enter the system in any form, combination, or mode of exhibition. In such cases, and also when the system is not as prompt in responding to the use of the medicine as is desirable, the article should be conjoined with some nauseant, as ipecacuanha or tartar emetic, with a view to more thorough relaxation of the system. The operation of the medicine may also be aided with frictions of mercurial ointment upon the groin, the inside of the thighs, the arm, and axilla, thrice in the twenty-four hours, for fifteen minutes at a time, the inunction being performed near a fire with the hand well protected with a pair of gloves, otherwise the assistant may salivate himself long before he succeeds in affecting the patient. From one to two drachms of the ointment will suffice at each application. Employed in this way, the effect is sometimes more rapid than when the medicine is given internally, though the constitutional impression is more mild and evanescent. The practice, however, is a very filthy one, and on that account is seldom resorted to by the modern practitioner.

There are circumstances which altogether contra-indicate the use of mercurials in almost any form. Most of the horrible effects which

are so often witnessed in this country, especially in the southwest, where this medicine is more liberally administered than in any other section of the United States, are, I am satisfied, entirely attributable to the reckless and indiscriminate manner in which the article is given in all states of the system and in every possible variety of circumstance. Persons of a strumous habit of body, the old, the infirm, the ill-fed, the badly clothed, and the anemic, are particularly prone to suffer from the use of mercury, even when exhibited only in small quantity. It is in subjects of this description, more especially, that we so frequently witness those frightful ravages of the mouth, teeth, jaws, and cheeks, that have almost led to the creation of a new department of surgery for their relief, and which have thrown so much discredit upon the profession in certain regions of the United States.

Finally, when salivation sets in, the best remedies are astringent gargles, cooling laxatives, emollient applications to the face and neck, and the liberal use of anodynes, to allay pain and nervous irritation. The lotion that I have found to answer better than any other is a solution of Goulard's extract, in the proportion of one drachm to eight ounces of water, used every hour or two, the only objection to it being that it discolors the teeth, an effect which, however, soon disappears of its own accord. Gargles of alum, tannin, copper, zinc, and other astringent substances also prove beneficial, especially if not employed too strong. When the inflammation runs very high, leeches to the throat and jaws may become necessary; and it may even be required to scarify the tongue, to prevent suffocation.

The best internal corrective of salivation is the chlorate of potassa, administered in doses of from fifteen to thirty grains three or four times a day, in a large quantity of sweetened gum water, or lemonade, to render it more soluble. This medicine seems to act with peculiar efficacy upon the digestive organs, and may often be advantageously resorted to as a prophylactic during the exhibition of mercury. It may also be beneficially employed as a gargle, from one to two drachms being dissolved in a pint of water, and the solution used every two or three hours. In very intractable cases of ptyalism, an emetic of ipecacuanha, morning and evening, will often answer when almost everything else has failed.

4. *Emetics.*—Emetics are not as often used now as they were formerly in the treatment of inflammation, their employment having been, in great measure, superseded by cathartics and other evacuants. Their exhibition, at the present day, is limited almost exclusively to cases in which there is marked gastric and biliary derangement, as denoted by the nausea and vomiting, the headache, lassitude, and aching o the back and limbs which sometimes so greatly oppress the patien in the earlier stages of his illness. When these symptoms are present, and there is no contra-indication, an emetic often acts like a charm, not only ridding the stomach of irritating matter, but allaying vascular excitement, promoting perspiration, and, in fact, unlocking all the secretions. Emetics are, of course, not used in the phlegmasias of the

sub-diaphragmatic organs, as gastritis, enteritis, peritonitis, hepatitis, and cystitis, for the reason that the concussion caused by their action could not fail to prove eminently injurious. For the same reason they are withheld in wounds of the intestines, hernia, fractures, and dislocations. In cephalic and cardiac affections they should also be carefully avoided.

The best forms of administration are tartar emetic, and ipecacuanha; common salt, alum, and ground mustard, also occasionally answer a good purpose, their effect being generally prompt and efficient. Whatever substance be employed, its use should always be followed by large draughts of tepid water, chamomile tea, or infusion of valerian, the latter being particularly beneficial in nervous and hysterical subjects. As a general rule, tartar emetic should never be given, on account of its sedative and irritating effects, to very young children and to persons who have become enfeebled by age and disease.

5. *Depressants.*—Depressants, or nauseants, are justly entitled to a high position in the scale of antiphlogistic agents. As their name implies, they are remedies which, by lowering the action of the heart, lessen the momentum of the circulation, and diminish the flow of blood to the affected tissues. This, however, is not the only good which they are capable of doing; by the impression which they make upon the nervous and sanguiferous systems, they become instrumental in re-establishing and improving the secretions, and in thus indirectly controlling the morbid action. There is, in fact, not a single organ which does not feel, to a greater or less extent, their influence, or which is not brought, more or less, under their dominion. The effect of this operation is often witnessed during the exhibition of tartar emetic in nauseating doses, in the relaxed skin, the softened pulse, the moistened tongue, and the pallid countenance, all bearing testimony to the universal impression of the remedy. Judiciously employed, depressants are among the most valuable and efficient antiphlogistic means that we possess, and they have the advantage that they may often be used without any preliminary depletion of any kind. Their beneficial effects are particularly conspicuous in inflammation of the respiratory organs, of the eye, the joints, and fibrous structures; also in certain forms of inflammation of the skin and cellular tissue. In many of these affections, if not in all, they have almost entirely superseded the use of the lancet and other evacuants, their controlling influence over the morbid action being generally most striking and satisfactory. Their efficacy is hardly less apparent in many of the diseases of the sub-diaphragmatic viscera; but their exhibition here demands greater care and vigilance, as their emetic effects could not fail to prove prejudicial. Their employment is particularly adapted to the treatment of acute inflammation of young, robust subjects, whose systems require to be rapidly impressed in order to arrest the progress of their diseases. Infants and children, the old, infirm, and decrepit, bear their use badly, and often sink under their injudicious administration.

The most trustworthy depressants are tartar emetic and ipecacuanha,

to which may be added aconite, veratrum viride, and digitalis, which, however, hold a subordinate rank. Of the depressing effects of bleeding I have already spoken, and pointed out the circumstances under which they may be most readily produced.

Tartar emetic, as a depressant, may be administered in doses varying from the eighth to the fourth of a grain, repeated every two, three, or four hours, according to their impression, which should be steadily maintained until the object of the administration of the remedy has been fully attained. It will generally be safest to begin with a small quantity, and to increase it gradually if it be found to be borne well by the stomach. Sometimes the first few doses, even if small, will produce pretty active emesis, but this, so far from being injurious, will commonly be highly beneficial, by relaxing the system and opening the emunctories. By and by, gastric tolerance will be established, and then the remedy will often be borne in extraordinary quantities, though we never employ it in the enormous doses recommended by Rasori, Thomasoni, and other disciples of the Italian school. It is seldom, indeed, in this country that we give as much at a single dose as half a grain, the average quantity rarely exceeding one-half or one-third that amount. The Italian practitioners, on the contrary, often gave five, ten, and even fifteen grains at a dose.

The beneficial effects of tartar emetic, as a depressant, may often be greatly enhanced by the addition to each dose of a small quantity of the salts of morphia, just enough to produce a calming and diaphoretic impression. Such a combination is particularly serviceable in nervous, irritable persons, and in subjects who have been debilitated by intemperance and other causes of exhaustion. When the article, given by itself, is productive of vomiting, it should never be used in any other way. In children, too, such a mode of exhibition is, as a general rule, indispensable. Sometimes the article may be advantageously administered along with the neutral mixture.

The dose of *ipecacuanha*, as a depressant, varies from a fourth of a grain to a grain, and may be used alone or in combination with an anodyne, as, indeed, is usually found best. A nauseant effect may be kept up in this manner almost as long as may be desired, but the impression is less pervasive and far inferior, in every respect, to that produced by tartar emetic. On this account, however, the medicine is peculiarly adapted to the treatment of inflammatory affections of children, who, as already stated, usually bear the operation of antimony very badly.

Whichever of these two articles be employed, it will be well to withhold all drinks for from fifteen minutes to half an hour after the exhibition, as, when this precaution is neglected, they are very apt to cause vomiting. At the end of this time, however, diluents, cool or tepid, may be used with the greatest benefit, from their tendency to promote relaxation and secretion.

Of *digitalis* I have not been led to form a very favorable opinion as a depressant or sedative. I was formerly in the habit of employing it a great deal in various forms and combinations, as well as in various forms and stages of inflammatory disease, and yet it would be diffi-

cult for me to recall a solitary case in which I derived any appreciable benefit from it. I have, therefore, of late years altogether abandoned its use.

Modern materia medica has gained an important accession in the addition of *aconite* as an antiphlogistic agent. The form in which it is usually exhibited is in that of the saturated tincture of the root, prepared according to Fleming's formula, the dose of which is from one to five drops repeated every two, three, or four hours, until it has produced its peculiar depressing effect. The best, because the safest, plan is to begin with a small quantity, and to increase it gradually and cautiously until it brings down the pulse, which, in the course of a few hours, often descends from ninety-five or one hundred to sixty-five or even fifty, the surface at the same time becoming bathed with perspiration. In large doses, it is powerfully sedative and anodyne, but it should never be given in this way on account of its prostrating influence. It is particularly adapted to neuralgic, gouty, and rheumatic affections, and to the higher grades of traumatic fever; and my practice generally is to combine it with tartar emetic and sulphate of morphia, as this insures a more prompt and beneficial action than when given by itself.

Veratrum viride is an American remedy, introduced to the notice of the profession by Dr. Osgood, of Providence. Its properties were subsequently investigated by Dr. Norwood, of South Carolina, who found it to exert a powerful influence upon the action of the heart and pulse, very similar to that of aconite, only, if possible, still more certain. The dose of the saturated tincture, the form of the medicine most generally employed, is from five to eight drops, repeated every two, three, or four hours, until it has sensibly reduced the force and frequency of the pulse, when it is either suspended or given in smaller quantity. As veratrum viride is an article of great potency, it is impossible to be too careful in its use. If carried too far, it causes nausea and vomiting, excessive prostration, faintness, vertigo, dimness of sight, and other dangerous symptoms. It is applicable to the same class of cases as aconite, and may be exhibited either by itself or in union with morphia and tartar emetic.

6. *Diaphoretics.*—Diaphoretics, in their mode of action, bear the same relation to the skin that cathartics do to the bowels. They constitute, therefore, a highly important class of remedies in inflammation, from the faculty which they possess of restoring and modifying the cutaneous perspiration, the suppression of which is a frequent source of disease. The quantity of perspiration daily thrown off by the skin, in the normal state, varies from twelve to sixteen ounces, and the retention of such an amount of material in the system must necessarily exert a most prejudicial influence upon the suffering organ. The importance of a critical sweat, as it was called by the ancient physicians, in putting a stop to disease, has long been familiar to the practitioner, and the employment of diaphoretics is only an attempt to imitate nature's efforts, in removing a cause of morbid action, or restoring a

secretion which has been suppressed in consequence of the changes which that action has induced in the general system. As in the case of purgatives, depletion should always precede the employment of the remedy, so should it in the case of diaphoretics, a relaxed condition of the body always powerfully predisposing to a favorable action of the medicine.

The class of diaphoretics is very large, but there are only a few that are really at all reliable, or that are much employed by the experienced practitioner. These are tartar emetic, ipecacuanha, and Dover's powder, aided, if necessary, by tepid drinks, and sponging of the surface with tepid water. The spirit of Mindererus, in combination with a small quantity of spirit of nitric ether, makes a mild diaphoretic, and is often used in low states of the system. The efficacy of antimony, which deserves the highest rank in this class of remedies, will be greatly increased if given in union with morphine, the two articles thus counteracting the bad effects which they would produce if exhibited alone, at the same time that they subdue the heart's action, relax the skin, relieve pain, and induce sleep. The best form of exhibition is a watery solution, each dose containing from the sixth to the tenth of a grain of antimony, with from one-fourth to one-eighth of a grain of morphia, repeated every two, three, or four hours. Ipecacuanha is adapted chiefly to children and old persons, and to the latter stages of the disease, and may be given alone, or, what is preferable, with some of the salts of opium. The ordinary dose of Dover's powder, for an adult, is ten grains, but in my own practice I seldom use less than fifteen, and frequently as many as twenty, repeated every eight, ten, or twelve hours. The action of these remedies should always be aided by tepid drinks, and, if there be much dryness of the surface, by frequent sponging of the body with tepid water. During very hot weather, and in high states of inflammation, cool ablutions are often more efficient, as well as more grateful, than warm.

Bathing is not often employed in the treatment of acute inflammation, on account, chiefly, of the inconvenience and fatigue attending its use. In the chronic form of the disease, however, it is a remedy often of great value, especially in affections of the skin, joints, and abdominal viscera. The water, which may be simple or medicated, is used at various degrees of temperature, the tepid bath ranging from 85 to 92 degrees of Fahrenheit, the warm from 92 to 96, and the hot from 96 to 112. A very excellent and convenient mode of conveying moist and heated air to the patient's body, as he lies in bed, consists in attaching one end of a tin tube, from three to four feet in length, to a teakettle filled with hot water, the other end being placed under the bedclothes. Copious perspiration usually promptly follows the application, which may be maintained for any desirable period. The foot-bath is occasionally used with advantage, but to derive full benefit from it the patient should be well covered up in bed, his feet hanging in the water placed in a suitable tub upon a chair, the immersion being continued from thirty to sixty minutes. The hip-bath is employed chiefly in affections of the genito-urinary organs.

7. *Diuretics.*—Diuretics are medicines intended to restore and modify the renal secretion, which is almost invariably more or less changed in inflammatory affections. Their employment is always, as a general principle, preceded by various depletory measures, and they are never given in inflammation of the kidneys and bladder. Their administration is usually accompanied by mucilaginous drinks, but these are not at all necessary to their beneficial effects, ordinary fluids answering quite as well. They may be conveniently arranged under three distinct heads: The first includes those articles which, when received into the system, depurate the blood, and increase the quantity of solid matter of the urine, as the nitrate, acetate, and bitartrate of potassa. The second class comprises colchicum, squills, and certain vegetable diuretics, which carry off the watery portions of the blood; and the third consists principally of copaiba and cubebs, which not only augment the renal secretion, but exert a peculiar influence upon the mucous membrane of the bladder and urethra, as is shown in cystitis and gonorrhœa. Of these various articles, the most important, in the treatment of acute inflammation, are nitrate of potassa and colchicum. The former may be exhibited in doses of from fifteen to thirty grains every four, five, or six hours, in a large quantity of water. Colchicum is generally given in the form of the vinous tincture, in doses varying from ten to fifty drops, several times in the day and night. My own practice usually is to use a drachm along with a grain of sulphate of morphia every evening at bedtime. In this way the medicine produces a much more decided impression upon the system, as well as upon the renal secretion, increasing its quantity, and freeing it of lithic acid. Moreover, it usually acts upon the bowels, bringing away thin watery evacuations, especially when employed by itself; and in large quantities, it often vomits. One full dose, administered in this manner at bedtime, is, I am satisfied, far superior to three or four small ones, which often fret and irritate the kidneys and bowels, placing them in a condition ill calculated to correct morbid action.

8. *Anodynes.*—There is no class of remedies which require a greater amount of nice judgment and correct discrimination in respect to their selection, mode of combination, and time of administration than that of anodynes. The subject, therefore, is one that should be carefully studied with reference to these particular points, by every one desirous of acquiring correct views of the practical application of anodynes to the treatment of inflammatory affections. My conviction is, from the opportunities that I have had of forming an opinion, that these remedies are used much less freely than they should be, and that they are capable, if properly exhibited, of affording an immense amount of benefit, not only in allaying pain and inducing sleep, but frequently also in controlling morbid action, and, consequently, in abridging its course. Space will not permit me to enter fully into this subject, and I shall, therefore, be obliged to confine myself to a brief statement of a few of the leading facts, giving them as practical a bearing as possible.

The same rules, as respects the premising of depletory measures,

are applicable to anodynes as to cathartics. Wherever there is plethora, fecal distension, or disorder of the secretions, their correction should, if possible, precede the exhibition of the opiate. Sometimes a full dose of morphia is made to succeed a large bleeding, or an active purgative, the medicine then exercising a decidedly sedative and soothing influence. Administered before the system has been properly relaxed, it rarely fails to increase the vascular action, to lock up the secretions, produce headache, prevent sleep, and augment thirst and restlessness.

A second rule, in the use of anodynes, is to exhibit the remedy, whenever its employment is indicated, in full doses, experience having shown that they make a much stronger, as well as a much more soothing, impression in this way than when they are taken in small, and frequently repeated doses. With the precautions pointed out, an adult will bear, when the symptoms are at all urgent, from two to four grains of opium every twelve or twenty-four hours. The effects of the remedy must be steadily watched, especially if the patient be a child, or there be any undue excitement about the brain. Should the pulse increase in fulness and vigor under its influence, the skin become more hot and dry, or the vigilance and restlessness augment, repetition is temporarily suspended, until, by farther depletion, the system is placed in a more favorable condition for its reception.

Thirdly, the best period for the exhibition of the medicine, when there is no immediate necessity for its use, is towards bedtime, the patient being thus more likely to obtain quiet and refreshing sleep after the removal of the light and other external stimulants.

Fourthly, when there is excessive pain along with great dryness of surface, and the depletion has been already carried to a sufficient extent, the anodyne should be combined with a diaphoretic, as ipecacuanha, or, what is better, tartar emetic, or, instead of this, a full dose of Dover's powder is given.

Anodynes are particularly beneficial in all cases of inflammation attended with violent pain, which, by its persistence, might rapidly wear out the powers of life. Their value cannot be too highly appreciated in the phlegmasias of the skin and cellular tissue, the joints, the sub-diaphragmatic viscera, the eye, ear, pleura, heart, and respiratory organs. Within the last few years enormous doses of opium have been given by Professor Clark and others in peritonitis with the most happy results, and I am sure that the same mode of treatment might be advantageously extended to inflammation of many of the other parts of the body. The importance of absolute rest to the affected organ is universally conceded, and is daily witnessed in the management of external inflammation. Instinct alone is often sufficient to secure it, but where this fails the surgeon endeavors to procure it by means of various mechanical appliances. In the internal phlegmasias no such means are applicable, but here the object may be readily attained by opiates, given in full and sustained doses to control the movements of the suffering structures. In gastritis nothing so promptly and effectually quiets the muscular fibres of the stomach as a suitable quantity of morphine, and the same treatment has long been success-

fully employed in dysentery, or inflammation of the lower bowel. In cystitis nothing affords relief so speedily and permanently as a full anodyne. In pleuritis and pneumonia, how is it possible to give rest to the lungs and respiratory muscles, except by the same means? The more quietly the parts are kept while laboring under disease, the sooner, other things being equal, will the patient recover from its effects, and the less pain he will have to endure from the constant and rude contact of the affected surfaces upon each other. Even in inflammation of the brain and its meninges, after proper depletion has been practised, anodynes are frequently indispensable, not only to allay pain and induce sleep, but to control the morbid action. And how do they do this? Simply, in the first place, by subduing the action of the heart, and thus preventing it from sending out to the brain its accustomed quantity of blood; and, secondly, by making a direct impression upon the brain itself, thereby, in some degree, controlling its movements, so injurious both to its own substance and to its coverings, when thus affected. Anodynes, in most of these cases, as well as in many others, literally constitute nature's splint.

The best anodynes are opium and its different preparations, as the salts of morphia and laudanum. These may be given either by the mouth or rectum, double the quantity being usually required to produce the same effect in the latter as in the former case. Sometimes the remedy is employed endermically. There are some persons who cannot bear opium in any form. When this is the case a substitute should be sought in lupuline, hyoscyamus, Indian hemp, and other kindred articles; or, in what I have generally found to answer very well under such circumstances, a union of morphia with tartrate of antimony and potassa.

9. *Antiphlogistic Regimen.*—Under this head are comprised the patient's diet, and the care which he may require during his confinement. The subject is one which rarely receives the attention its importance demands.

Few persons, fortunately, have any appetite during the height of an inflammatory attack, and hence the surgeon seldom experiences any difficulty in regard to the regulation of the diet. The stomach being oppressed with nausea, or a sense of uneasiness, either loathes food, or rejects it almost the moment it is swallowed. It is well it should be so; for any ingesta, however mild, taken at this period, would only become a source of further trouble, by increasing the morbid action, perhaps already progressing at a furious rate. Where the appetite remains, it must be repressed, steadily and courageously, until all danger from over-excitement from its indulgence has been safely passed. The mildest and least nutritious articles only are admissible in the earlier stages of the disease; such as panado, gruel, arrowroot, sago and tapioca. Not even the lightest animal broth is permissible, unless there is decided tendency to prostration, or an irritable state of the system, clearly dependent upon the want of proper nourishment, as occasionally happens in persons of a nervous, irritable temperament, or who are habitually huge feeders. The drinks should be cooling, consisting of iced

water, gum-water, linseed tea, or barley water, either simple, or slightly acidulated with lemon-juice, tamarind, or any of the subacid fruits; care being taken that, while they are used freely, they are not employed in such quantity as to produce gastric and intestinal oppression.

Rest of mind and body must be carefully observed. The importance of this is so self-evident that it would be folly to attempt to enforce it by any labored argument. Whatever has a tendency to excite the heart's action must necessarily increase the momentum of the circulation, and, through it, the inflammation. In all severe attacks the patient must keep his bed, from which he must not rise even to answer nature's calls; light and noise are carefully excluded from his apartment, especially if he is suffering from inflammation of the eye, brain, or ear; and no persons should be permitted to be about him, except such as are absolutely necessary to nurse him. Many a patient is killed by the kindness of his friends and relatives.

Attention must be paid to the temperature of the patient's room, this being regulated, not by his feelings, which are often deceptive, but by the thermometer. On an average, it should not exceed 65°, but in some cases it may range as high as 70°, and in others as low as 60°. The apartment should be frequently ventilated. When it is recollected how soon the air becomes vitiated during sickness, and how important a due supply of oxygen is to the proper maintenance of the health, the importance of attention to this subject will not be doubted. Cleanliness of the body, and of the bedclothes, is another subject of vital importance in the treatment of inflammation, and one to which, I am sure, few practitioners pay sufficient attention. To medicate the inside of a patient while we neglect the outside is one of those singular inconsistencies of which we see daily proofs in the sick chamber. I would not insist upon too frequent ablutions and changes of the body and bedclothes, but they should certainly, in ordinary cases, be effected at least once in the twenty-four hours; care being taken to avoid unnecessary exposure and fatigue during their performance. Even the arrangement of the furniture should be attended to, on the principle that an agreeable impression, of whatever kind, is more conducive to comfort and recovery than one of an opposite character.

II. Local Treatment.—The local remedies of inflammation consist of rest and elevation of the affected part, the abstraction of blood, cold and warm applications, compression, and counter-irritation.

1. *Rest and Position.*—Without rest, steady and persistent, of the affected part, little progress can be made toward the cure of inflammation. The practitioner who neglects attention to this important circumstance, performs only half his duty. The patient, ignorant of its advantages, often continues to exercise the affected organ long after it has become unfitted for the discharge of its functions, much to his present discomfort and ultimate detriment. A simple conjunctivitis, that might be cured in a few hours, is often urged, for the want of a little rest of the eye, into a violent and protracted ophthalmia, perhaps, at

length, eventuating in total loss of vision. An inflamed joint is frequently, for the same reason, rendered permanently stiff and useless. Hence, rest is universally considered as one of the most essential elements of the local treatment of inflammation. In general, it is easily procured, simply by the patient's own efforts; but where this is not the case, it must be insured by appropriate splints, and other means, applied so as not to interfere with the other treatment. In inflammation of some of the internal organs, as the heart, stomach, peritoneum, bowels, and urinary bladder, the object is sought to be obtained by the liberal use of anodynes, which, by temporarily paralyzing the muscular fibres of the affected structures, effectually prevent peristaltic motion, and thus place them in a better condition for speedy recovery.

But there is a period when rest must not be enforced too rigidly, for when it is continued too long, it may be productive of much harm. Its great utility is in the earlier stages of inflammation, when morbid action is gravescent, and for some time after it has reached its culminating point. When it has fairly begun to decline, motion, gently and cautiously conducted, is often of great utility.

Not only should the part be kept at rest, but it should also be maintained in an elevated position, the success of the treatment being thereby greatly enhanced. The importance of attention to this point is well exemplified in many familiar diseases. The patient himself is often conscious of it, and, therefore, resorts to it, as it were, instinctively. Who that has ever had an attack of whitlow, does not remember the great relief which he experienced from carrying his hand in an elevated position? The effect of position is nowhere more strikingly evinced than in odontalgia. During the day, the patient, while attending to his business, is, perhaps, hardly sensible that anything is the matter with him, but, at night, no sooner does his head touch the pillow, than the tooth begins to ache and throb, compelling him to get up and pace his room. In orchitis, the beneficial effects of our remedies are greatly aided by elevation conjoined with rest of the affected organ. It is quite easy to understand why this should be so. In inflammation, the vessels carry an extraordinary quantity of blood, which is still further increased when the suffering structures are placed in a dependent position, because the flow, not being opposed by gravity, has then free scope, thus crowding the already distended capillaries to the very utmost, and proportionably aggravating the morbid action.

Finally, the inflamed part should be maintained not only at rest and in an elevated position, but in as easy a position as possible, mere rest and elevation not sufficing to insure comfort. All restraint must be taken off; all muscular contraction effectually counteracted. Thus, in inflammation of the knee-joint, the limb should recline upon its outer surface, a pillow being placed in the ham, this being the best position for preventing tension. In synovitis of the elbow-joint, the forearm is bent at a right angle with the arm; and in hip-joint disease, the thigh is slightly flexed upon the pelvis, and turned towards the sound one.

2. *Local Bleeding.*—Blood may be abstracted locally by scarification, puncture, leeching, and cupping, each being more or less serviceable, in its own way, in particular cases and under particular circumstances.

The manner in which topical bleeding affords relief is sufficiently evident in some of these forms of depletion, but not very apparent in others. Thus, in scarifying and puncturing a part, the blood is taken directly from the engorged vessels, which are thus drained of their altered and vitiated contents. If the operation be carried to any considerable extent, as it often may be, especially in the former of these procedures, we may, at the same time, make a powerful impression upon the general system, nearly as rapidly and quite as effectually as when blood is drawn from a vein at the bend of the arm, although, in general, such an effect is neither aimed at nor desired. A similar influence is exerted by leeching and cupping, provided the operation is performed upon the inflamed surface, or in its immediate vicinity. Frequently, however, it is performed at a remote point, and then its mode of action is rendered more difficult of comprehension. Thus, in inflammation of the brain, it is difficult to determine how leeches and cups, applied to the nape of the neck, the temples, or back of the ear, afford relief to the affected organ. It is certainly not possible, in such a case, to make any direct impression upon the seat of the disease; whatever influence is exerted, must be exerted through the general system. This is a self-evident proposition. The vessels of the neck and scalp have no direct communication with the vessels of the brain; and hence, in leeching and cupping these parts, we can no more drain the cerebral capillaries than we can drain those of the hand, chest, or any other distant part. We may assume, then, that, when topical bleeding is practised by either of the latter methods, its beneficial effects are due not to any direct drainage of the suffering structures, but indirectly to the depressing influence which it exerts upon the heart and nervous system, and, through them, upon the morbid action, diminishing the momentum of the circulation, and, consequently, the flow of blood in the capillaries at the seat of the inflammation.

Whatever, however, may be its mode of action, whether it is produced in the manner in which we have attempted to explain, or by some revulsive agency, so much insisted upon by some of the older practitioners, and which it is so difficult to comprehend, topical bleeding, to be efficient, should always, if possible, be preceded by general depletion. When the force of the morbid action has been broken in this way, the rest of the malady is often well dealt with by local abstraction of blood. It is only when the disease is very mild, or when there is no marked constitutional disorder, that this rule should be disregarded. Under such circumstances, the treatment may occasionally be very properly commenced with the application of leeches, cups, or scarification, followed or not, as the exigencies of the particular case may seem to require, by other measures.

3. *Cold and Warm Applications.*—These remedies, which are more

particularly adapted to external inflammations, comprise a great number of articles, in the form of water dressings and cataplasms, with the character of which every practitioner should be perfectly familiar. Both classes of remedies may be simple or medicated, according to the tolerance of the part and system, and the nature of the morbid action.

(1.) *Cold water* has been employed in the treatment of inflammation almost from time immemorial; but its beneficial effects were lost sight of, in great measure, until attention was recalled to it by some of the military surgeons of Europe, early in the present century. In this country, the subject has hardly yet received the consideration it deserves, the use of the article having hitherto been confined chiefly to hospital practice. From its value, however, as a topical application, it must soon find its way to general favor, and take its place among the great remedies for the cure of inflammation, especially as it occurs in the external parts of the body.

It is not difficult to conceive how cold operates in subduing morbid action. Its chief effect is evidently that of a sedative, lowering the temperature of the part, and causing contraction of the vessels, thereby relieving pain, swelling, and tension. It is particularly applicable to inflammation in its incipient and ingravescent stages, while there is, as yet, little effusion, and no serious structural lesion. When the action has reached its acme, threatening suppuration, or, what is worse, tending to gangrene, it is usually hurtful both to part and system, and must be promptly discontinued. Besides, it should not be forgotten that cold, when intense, or protracted, may of itself cause gangrene. Young and robust persons usually tolerate such applications much better than the aged and feeble; they are also better borne in summer than in winter. As it is impossible always to determine beforehand, in any given case, what their effects will be, their action should be carefully watched, in order that, if they should become a source of annoyance, they may either be entirely dispensed with, or employed in a modified form.

The water may be rendered anodyne, astringent, or antiseptic, according to circumstances, by the addition of opium, acetate of lead, or some of the chlorides. The best way to use it is to cover the affected part with a piece of old porous linen, and to direct upon it a constant flow of water from a basin with a stop-cock, slung to the top of the bedstead, the limb lying on an oil-cloth trough, from which the fluid is conducted into another vessel standing near the bed. Or the part may be covered with a wide, thin piece of sponge, spongio-piline, or common linen, over which is placed a bladder partially filled with pounded ice. Or the water may be conveyed from a basin by means of a candle wick to a layer of lint upon the inflamed surface, the wick acting on the principle of a syphon. Finally, when ice cannot be obtained, the water may be rendered cold by means of alcohol, in the proportion of one part to six of the fluid; by pyroligneous acid and alcohol; or by the admixture of a strong solution of hydrochlorate of ammonia and nitrate of potassa. In whatever manner the fluid is employed, the part to which it is applied should be constantly exposed to the air, to favor evaporation.

(2.) The use of *warm water* is also of great antiquity, having been employed by Hippocrates and other practitioners in gangrene and various cutaneous affections. It has, however, only been within the last fifteen years that it has assumed anything like the rank to which its importance as an antiphlogistic remedy entitles it. In my own practice, I generally give a decided preference to warm water over cold, the impression made by it upon the part and system being usually more agreeable and soothing, while there is much less danger of metastasis, or of a sudden transfer of disease from the external to the internal parts of the body. It is particularly adapted to nervous, irritable individuals, who are easily chilled by cold applications, and to cases in which the inflammation has already made considerable progress, where there is much tension and swelling, or where suppuration is impending, or has already taken place. A good rule, both in regard to warm and cold applications, is to consult the feelings of the patient, using one or the other according to the tolerance of the part and system, or simply so long as they seem to be beneficial. When a change becomes requisite, care must be taken that it is not too sudden, lest it produce harm. Thus, hot applications should be succeeded first by warm, then by tepid, afterwards by cool, and finally, if necessary, by cold, the transition being gradual and wary, not great and sudden, so as to shock the part and system, and thus cause undue reaction.

Warm water may generally be advantageously combined with opium, or with opium and acetate of lead, or with opium and hydrochlorate of ammonia. The latter is the preparation which I generally prefer, the opium and ammonia being dissolved in hot water, in the proportion of about two drachms of the former and an ounce and a half of the latter to the gallon of fluid. A piece of old flannel of suitable size, and arranged in several thicknesses, is then wrung out of the solution, and laid upon the inflamed surface, a covering of oiled silk being spread over the cloth, to confine the heat and moisture. As the cloth becomes dry, it is wet, from time to time, not by re-immersion, but simply by pressing the solution upon it from a sponge; dressing by substitution being necessary only in the event of the flannel becoming soiled and offensive by the discharges. The only objection to the hydrochlorate of ammonia is its liability to cause slight pustulation, especially in persons of a delicate skin; when this happens, its use must be suspended. In the employment of cold water, the part is exposed; in the use of warm, it is covered. The former does good by constringing the inflamed tissues, and opposing effusion; the latter by relaxing them, and favoring effusion.

(3.) *Fomentations*, which may be considered as a species of local bathing, are often beneficially employed in inflammation of the joints and of some of the internal viscera, being particularly calculated to relieve pain, tension, and spasm. In cystitis, gastritis, enteritis, and peritonitis, as well as in wounds and other injuries of the pelvic and abdominal organs, their employment can rarely be dispensed with in any case. The most simple fomentation consists of a large, thick flannel cloth, wrung out of hot water, or water near the boiling point, by means of two sticks turned in opposite directions, and applied

lightly to the part as hot as it can be borne. If a soothing, narcotic, or sedative influence is required, chamomile flowers, poppies, hops, or, what is much better, laudanum, or laudanum and brandy, will be found to form valuable additions. In whatever manner they are used, they should be frequently renewed, and care should also be taken that there are two cloths, so that, while one is taken off, the other may be immediately applied, all danger of shock and reaction from exposure to the air being thus avoided.

(4.) *Stuping* is a variety of fomentation serviceable in many cases, but particularly in affections of the eye, nose, ear, mouth, and throat. It is conducted with a piece of flannel, rolled into a kind of ball, which the patient holds in a small pitcher, at such a distance from the affected surface that the vapor may ascend to it, care being taken to wet the cloth as often as it becomes cool. The remedy may be medicated, if desired, with laudanum, camphor, belladonna, hemlock, or any other article, anodyne, astringent, or sorbefacient.

When it is desirable to apply steam more directly, a funnel may be inverted over the hot fluid, and the tube held towards the affected surface at a suitable distance. Steam may be conveyed to any part of the patient's body, under the bedclothes, by means of a large gutta-percha tube, attached to a small tin boiler, placed upon a table, and heated by a spirit lamp.

(5.) *Poultices*, technically called cataplasms, are an important class of remedies, intended for external application in inflammation, wounds, ulcers, abscesses, and other affections. They are modifications of fomentations, and are made of various substances, either simple or medicated, according to the object they are intended to fulfil. They should be of such consistence as to accommodate themselves accurately to the surface to which they are applied, without being so tenacious as to adhere firmly to the skin, or so thin as to spread over the neighboring parts. They should never be heavy nor bulky, and they should be renewed as often as they become dry and cold; otherwise they lose their good effects and are converted into irritants. In general, it is sufficient to change them thrice a day; but in warm weather, or when there is much discharge, it may be necessary to reapply them every four, five, or six hours. Their temperature should be about the same as that of the body, that is, from 85 to 92 degrees of Fahrenheit, and they should be placed directly upon the affected surface in a uniform layer of from three to four lines in thickness, a piece of bobbinet, gauze, or thin netting being interposed to prevent sticking and facilitate removal.

The action of a poultice is usually limited to the skin, or, at all events, to the parts to which it is immediately applied; it is only when it is composed of very strong materials that its influence is more deeply felt. In using medicated cataplasms, it is necessary, especially when there is ulceration or abrasion of the skin, to be aware that the active ingredient may be absorbed, and thus produce the same effects as when introduced directly into the stomach. Poultices differ very much in their mode of action; thus, some are altogether emollient, that is, they soften and relax the parts to which

they are applied, at the same time that they promote exhalation and absorption; some are anodyne; some astringent; some antiseptic.

The following list comprises nearly all that are now in use, with brief directions for their preparation:—

a. The *bread* poultice is made by pouring boiling water upon the crumbs of stale wheat bread and stirring the mixture in a basin with the back of a spoon until it is of a thick, mushy consistence. It is then spread upon a piece of folded cloth large enough to cover not only the affected surface, but to extend a short distance beyond it. Milk may be used as a substitute for the water, but when thus prepared the poultice requires to be more frequently changed, as it soon becomes sour and offensive.

b. The *arrowroot* poultice is prepared in the same manner as when that article is used for food, only that it is rendered more consistent; it is mixed at first with cold water, and then with a sufficient quantity of boiling water to convert it into a thick, gelatinous paste. This poultice is admirably adapted for irritable sores, and deserves to be more frequently employed than it is.

c. The *slippery-elm* poultice is prepared from the powdered bark of the slippery-elm, moistened with hot water. It is very light and demulcent, and, therefore, well adapted for burns, excoriations, and irritable sores.

d. The *linseed* poultice, perhaps the best and most convenient of all, from its emollient properties, is made of ground linseed mixed with boiling water, and stirred until it is converted into a thick, cohesive mass. This poultice is always very easily prepared, retains its heat for a long time, and has a sufficiency of oil to keep it soft and prevent it from adhering.

Excellent emollient poultices may be prepared from apples, carrots, turnips, or any of the more tender culinary roots, by boiling them, after having removed the skin, and mashing them into a soft pulp. They possess, however, no peculiar virtues, and are therefore seldom used.

A poultice may be variously medicated. Thus it may be rendered astringent by the admixture of acetate of lead, Goulard's extract, alum, or a decoction of oak bark; anodyne, by laudanum, opium, morphia, poppy-heads, or hemlock; stimulating, by chloride of sodium, vinegar, or port wine; absorbent, by iodine and other articles.

The *fermenting* poultice, used in foul, fetid, and painful ulcers, in hospital gangrene, and in mortification, is prepared by incorporating a pound of wheat flour with half that quantity of yeast, the mixture being afterwards exposed to a gentle heat until it swells. The port-wine poultice, which belongs to the same class as the fermenting, is made in a similar manner, except that it is not boiled.

The charcoal poultice, also a good antiseptic application, though now rarely used, is prepared from recently burned charcoal, reduced to a very fine powder, and mixed with bread, oatmeal, or ground flax-seed. The objection to this poultice is its liability to discolor the affected parts, so as to prevent us from observing their real condition.

This may, however, be obviated, in great measure, by the interposition of a thin linen cloth.

A poultice may be rendered refrigerant by means of a freezing mixture, or a bladder partially filled with pounded ice and spread over its surface. Such an application, however, for reasons already stated, requires great care.

4. *Nitrate of Silver.*—There is no article which enjoys a higher reputation, as a local antiphlogistic agent, than nitrate of silver; certainly none that is more frequently employed. Without understanding its precise mode of action, experience has taught us its great value in the treatment of a large number of inflammatory affections, some of which it would be exceedingly difficult to cure without it, while nearly all are more or less benefited by it. Ever since its introduction into practice by Mr. Higginbottom, of England, as a topical antiphlogistic, it has been employed in almost every form of external inflammation, both in a solid and a fluid state. Indeed, very recently it has been employed, in the latter form, in cases of laryngitis, and one gentleman, Dr. Horace Green, of New York, has gone so far as to assert that he has even mopped the trachea and bronchial tubes with it. Its beneficial effects in diseases of the eye, throat, and genito-urinary organs have long been acknowledged by practitioners. In cutaneous affections, too, it enjoys a high and well-deserved reputation. In erysipelas it is perhaps more frequently used than any other single remedy, iodine alone excepted. Its value in the treatment of this disease, so common in this and other countries, is fully established, both in a curative and prophylactic point of view. In inflammation of the tonsils and fauces, whether the result of ordinary causes, of a strumous diathesis, or a syphilitic state of the system, no article is so generally employed, or enjoys so great a reputation, as the nitrate of silver. In gonorrhœa and gleet, in strictures and morbid sensibility of the urethra, in spermatorrhœa, in vaginitis, and metritis, nitrate of silver has become an indispensable means of cure. Indeed, it would be difficult to find an accessible disease, attended with preternatural vascularity and disordered structure, in which its application would not be productive of benefit.

Nitrate of silver may be used so as to afford a vesicant effect, as when it is applied to the skin, or simply as an alterant, or modifier of diseased action; for, as I have already stated, we know nothing definite of its mode of operation. When used for vesicating purposes, the solid form is usually preferred, the stick being passed lightly but efficiently over the surface, previously a little moistened with soft water, until there is evidence of slight coagulation of the albuminoid matter of the epidermis. A cloth, pressed out of warm water, is then applied, when vesication will soon follow. The same result may easily be produced by a saturated solution of nitrate of silver; but, as the remedy is less manageable, it is not often employed with that view. Unless applied in a very concentrated form, and for an unusual length of time, nitrate of silver never acts as an escharotic, or as a destroyer of the tissues.

The solid nitrate of silver is often used with great advantage in ulceration of the mouth and throat, the cornea, the skin, vagina, and uterus, the application being usually made very lightly, and repeated not oftener than once every third, fifth, or eighth day. Employed too frequently or too abundantly, it often does immense harm, not only occasioning severe pain, but sometimes seriously aggravating the morbid action. These effects may be produced equally by a strong solution as by the solid stick. A strong collyrium of nitrate of silver has destroyed many an eye, or urged on an inflammation, perhaps on the very verge of resolution, to a most distressing extent. Urethritis is often aggravated, and greatly protracted, by a strong injection of this description. Much judgment, then, it will be perceived, is requisite in the local use of this remedy, not only as it respects its strength, but also the mode and time of its application. Carefully adapted to the exigencies of each particular case, it exerts a powerful impression upon the diseased structures, diminishing vascular action, relieving pain, and destroying morbid sensibility, often so conspicuous in inflammation of the eye and throat, and which nothing else can so well control.

5. *Iodine.*—Hardly less valuable than nitrate of silver, as a topical remedy in inflammation, is iodine, first introduced to the notice of the profession, in this relation, by Mr. Davis, an English surgeon. It is generally used in the form of the officinal tincture, either pure or diluted with alcohol. Its great value seems to consist in its alterant and sorbefacient properties, changing the action of the capillary vessels, and promoting the removal of effused fluids. That this is the case is sufficiently apparent from what takes place in erysipelas of the skin, where the effects of the remedy may always be easily watched. Within a few hours after the application has been made the swelling is usually observed to be so much diminished as to cause a marked corrugation of the surface, attended with a diminution of pain and hardness; circumstances plainly denotive of lessened vascular activity, and progressive absorption. Similar effects are witnessed when the application is made to an œdematous uvula, scrotum, or eyelid, there being not only no further effusion afterwards, but a removal of what was previously deposited. From these facts, it may be inferred that iodine, locally applied, is not merely, as has sometimes been asserted, a sorbefacient, but also an alterant, or modifier of secernent action.

Although exceedingly valuable as an antiphlogistic, it is questionable whether iodine has received the attention it really deserves, or whether we are sufficiently acquainted with the class of cases to which it is more particularly applicable. Its reputation in erysipelas seems to be fully established, and I have certainly myself found no article at all comparable to it in that affection as an endermic remedy. It is also of great service in boils, carbuncle, whitlow, corns, bunions, and inflamed, irritable ulcers of the extremities. Its beneficial effects are hardly less conspicuous in active œdema of the uvula and tonsils, the legs, scrotum, prepuce, and pudendum, a single application often sufficing to produce the most marked change in the condition of the

part. As a collyrium and an injection, the value of iodine has not been sufficiently tested to enable us to form any definite opinion, but the trials that have been made with it, in this respect, are encouraging, and deserving of repetition.

For external use, I generally employ the tincture of iodine with an equal amount of alcohol, applying the mixture by means of a camel-hair pencil until the skin becomes of a deep yellowish color. The application may be repeated once every eight, twelve, or twenty-four hours, according to the exigencies of each particular case. If the remedy be used stronger than this it will be very apt to produce severe pain and to excite capillary action; two circumstances concerning which it is impossible to exercise too much caution. When intended for the tonsils, uvula, and other delicate parts, the dilution should, for the reason just mentioned, be still greater.

6. *Compression.*— Compression, as an antiphlogistic agent, has been too much neglected, nor has it always been judiciously used when resorted to. That it is capable of doing an immense deal of good, when employed with proper care, and under suitable circumstances, my experience fully justifies me in asserting. Why it is so rarely used, it is difficult to determine, unless it is that practitioners do not possess the requisite skill in its application and mode of management. Very little, certainly, is said about it in surgical treatises; and, as to our teachers, few seem to be aware that there is such an agent. My space will not permit me to enter as fully into the subject as I would desire; a mere outline of a few of the more important facts connected with it must, therefore, suffice.

Compression, although more particularly applicable to the latter stages of inflammation, is yet not without its value in the incipient and ingravescent period of the disease. Affording support to the affected structures, it is well calculated, when early employed, to give tone to the distended capillaries, enabling them to urge on their sluggish contents, and, consequently, to prevent their effusion into the surrounding cellular tissue. Immense good is often done in this way, as every one knows who has ever treated erysipelas, wounds, fractures, and dislocations, by compression. If two cases of any one of these affections, of precisely the same character, could be treated, one with the bandage, and the other without the bandage, simply by the ordinary topical remedies, the difference would be most striking. The compressed limb would be comparatively free both from pain and swelling, whereas the other would be highly sensitive and greatly enlarged, from inflammatory deposits. We see, in such circumstances, how, in the one limb, action is controlled, and how, in the other, it pursues its wayward course. But this is not the only benefit which systematic compression is capable of affording. When judiciously employed, it controls muscular contraction, and thus prevents spasm, both of which are frequently so annoying in fractures, dislocations, amputations, and various affections of the joints. Another effect, and that by no means the least striking and important, is the sorbefacient influence which it exerts, rousing the absorbent vessels, and compel-

ling them to remove the fluids that were deposited prior to the employment of the remedy. It is for this reason that compression may be so advantageously used in the latter stages of most of the external inflammations, attended with effusions of serum and fibrin, there being no means known to the surgeon so well calculated to effect this important object, and to assist in restoring the functions of the suffering parts. The treatment of orchitis by compression affords a beautiful and satisfactory illustration of the mode of action of the remedy under such circumstances. When this disease has been shorn of its violence by depletion, the swelling and induration, consequent upon the morbid action, often promptly disappear under the influence of systematic compression; generally, indeed, in one-fifth of the time in which they disappear under the use of mercury and ordinary sorbefacients. The absorption is frequently so rapid as to render it necessary to change the dressings twice in the twenty-four hours. Similar effects are sometimes observed in inflamed and enlarged joints.

The means of compression are the common bandage and adhesive plaster, applied in such a manner as to make gentle and equable pressure over the whole of the affected structures. Whenever the part admits of it, the bandage deserves the preference, as it is more easily managed, and equally efficient; but there are certain organs, as the testicle and mamma, where adhesive strips alone can be used. When an additional sorbefacient effect is desired, strips of gum ammoniac and mercurial plaster may be substituted for the ordinary plaster.

7. *Counter-Irritants.*—Counter-irritants are remedies which, when applied to the surface of the body, excite a new disease, or a new action, in a part more or less remote from the one originally affected. They are never used, or at least not as a general rule, until after pretty thorough depletion has been practised, by which the inflammation has been robbed of its violence, their effect being always more prompt and decisive under these circumstances. The new disease is generally established close to the original one, but occasionally at some distance from it. Thus, in inflammation of the hip-joint, the counter-irritant is usually applied as near as possible over the acetabulum and head of the thigh-bone, the immediate seat of the morbid action, and so with the other articulations. In disease of the neck of the bladder and prostate gland, it is applied to the perineum; of the pleura and lungs, over the nearest point of the chest. In inflammation of the eye, on the contrary, the irritation is established on the nape of the neck, behind the ear, or on the arm, and not in the immediate vicinity of the suffering organ. Great judgment is often required to determine the precise point where, as well as the precise time when, the new action ought to be instituted. If it be too near the original affection, it may run, as it were, into it, and thus cause an aggravation, instead of a mitigation, of the mischief; if, on the other hand, it be too remote, it may entirely fail of the object for which it was employed. Counter-irritation, as already stated, is never resorted to until the system has been relieved of plethora, and the morbid action weakened by other remedies. Used in the height of the morbid action, it can

scarcely fail to be productive of local and constitutional disturbance, calculated to exercise a prejudicial influence upon the progress and termination of the case.

The class of counter-irritants comprises a large number of articles of a very diversified character, and hence they may with great propriety be arranged under different heads, according to their mode of action, as destructives, vesicants, and suppurants.

(1.) *Destructives* are remedies which the surgeon employs to destroy the germs of certain diseases, as that of chancre, hydrophobia, and malignant pustule; and to neutralize certain poisons, as that of the snake, and the dead subject. Their action is either curative, or prophylactic; most generally the latter.

The most speedy and effectual remedy that can be used in the incipient stage of chancre is excision with the knife, or the destruction of the affected structures with some escharotic substance, as nitric acid, bichloride of mercury, or the acid nitrate of mercury. This plan should always be adopted whenever it is found that the poison has not yet had a chance of diffusing itself among the surrounding parts, inasmuch as it not only at once removes the local disease, but protects the system effectually from contamination, the little sore left by the knife or escharotic generally healing in a few days. The parts inoculated by the poison of hydrophobia and malignant pustule should be treated in a similar manner. When the knife is not admissible, on account of the timidity of the patient, the best remedy, according to my observation, is the acid nitrate of mercury, in the form of Bennett's formula, applied by means of a soft piece of wood, as a common match, or the point of a probe, inserted, if possible, into the part, and held there until the tainted structures are deprived of vitality. The same remedy, either pure, or properly diluted, is admirably adapted to the treatment of phagedenic ulcers and spreading gangrene, by whatever cause induced. It should not, however, be used without due precaution, as it is an agent of great power, and may extend its destructive influence much beyond the diseased limits. The ordinary nitric acid is less manageable than the acid nitrate of mercury from its liability to spread over the adjacent parts, and is now seldom used as an escharotic. Bichloride of mercury, dissolved in alcohol, in the proportion of two scruples to the ounce, is a most efficient caustic, producing a thin, soft, grayish eschar, which separates in a few days. It is used chiefly in venereal buboes, and always acts more promptly when its application is preceded by a blister. A powerful escharotic effect may be produced by a combination of three parts of bichloride of mercury with one of opium, made into a thick paste with concentrated sulphuric acid. The only objection to these preparations is the excessive pain they occasion, which is sometimes almost insupportable.

Similar means may be employed for neutralizing the poison of the rattlesnake and of other venomous reptiles, and for destroying the virus of wounds received in the dissection of dead bodies. In the former case, free excision is practised, followed by the use of the hot iron, or some escharotic substance; in the latter, the part is held for a

considerable time under a stream of cold water, then well sucked, and next thoroughly cauterized with acid nitrate of mercury.

(2.) *Vesicants* are remedies which, when applied to the skin, elevate the epidermis in the form of blisters filled with serum. They are of great value in the treatment of inflammation, both acute and chronic, and are applicable to a great variety of circumstances, with which the practitioner should be fully acquainted. The articles commonly used for this purpose are cantharides, either in powder or in the form of collodion-liquid, ammonia, and hot fluids. In acute disease these means, especially the first, are always preceded by active depletory measures, it being well known that, if they are employed before there has been a proper reduction of the system, they are liable to do mischief by increasing the local and general excitement. In chronic inflammation, however, they may often be advantageously used at the very commencement of the treatment. The vesicating agent is generally placed as near the affected part as possible; sometimes, indeed, directly over it.

Blisters, properly so called are prepared with the common fly ointment of the shops, and vary in shape and size according to the object they are intended to fulfil, or the region to which they are applied. The part, if covered with hair, is previously shaved, and the plaster is confined with a compress and roller, or, what is better, with a few adhesive strips. To prevent strangury, an object of great importance in all cases, but particularly in persons of a nervous temperament and in young children, I always order the surface of the blister to be sprinkled with a few grains of morphia and camphor. The same end may be attained, though less certainly, by the interposition of a piece of tissue paper, steeped in spirits of camphor. In addition to these precautions, the patient should be requested to make free use of some mucilaginous drink, as flaxseed tea, or gum Arabic water, either alone or combined with a little spirit of nitric ether. If strangury should occur, prompt relief may usually be afforded by a laudanum enema, and hot fomentations to the genitals and hypogastric region, aided, if necessary, by a dose of morphia by the mouth.

A blister should, on an average, remain upon the part from six to eight hours, unless the skin is very delicate, and sensitive, when a shorter period will suffice. In children, the desired effect is usually produced in from two to four hours, and it is necessary in them to be very careful, otherwise violent inflammation and even gangrene may be the result. I have seen horrible suffering, and, in two instances, death, follow the application of a small blister in children. In the very aged and infirm, similar accidents occasionally happen. Parts affected with paralysis often suffer severely from the protracted use of blisters. The plaster need not, in general, be kept on until there is thorough vesication; it is sufficient if the skin is quite red, or if there be here and there a little vesicle, the process being speedily completed by the warm water-dressing, or an emollient poultice, which are always the most suitable applications after the fly has been taken off. It is of great consequence to remove every bit of the salve, and also not to break the epidermis, but simply to puncture it with a

large needle or small bistoury, to admit of the necessary drainage, it being a matter of great moment to exclude the atmosphere from the raw surface beneath. The dressings already mentioned may be continued until new skin has formed. Should the surface, however, become red, inflamed, and irritable, bleeding upon the slightest touch, and rendering the patient feverish and restless, recourse must be had to the starch, arrowroot, or slippery-elm poultice, or to the common white lead paint, than which nothing is generally more soothing. It should be put on in a thick layer, which is then to be covered with a sheet of cotton, the whole being supported by a roller. Pencilling the part with a weak solution of nitrate of silver has sometimes a good effect, and so has also the dilute ointment of the oxide of zinc, especially when the surface is studded with large, irritable granulations.

Cantharidal collodion is a more elegant preparation than the common fly plaster, and may therefore advantageously take its place. It is best applied by means of a camel-hair brush, the surface to be vesicated being thoroughly covered with it, and the evaporation of the ether restrained by a piece of oiled silk, placed immediately upon the part. Unless this precaution be used, the article will require nearly as long a time to produce its specific effect as an ordinary blister. The principal advantages of cantharidal collodion are, that it can be more evenly applied to the skin, that it does not shift its position, that it is more rapid in its action, and that it is less liable to produce strangury, especially if it contain morphia in solution, an addition I would always advise.

Ammonia is used only when the effect is desired to be strong and immediate, as, for example, in croup, where the inflammation, if not promptly checked, may speedily destroy life. Equal parts of lard and powdered hartshorn will produce small vesicles in five or six minutes; and similar effects will follow the application of Granville's lotion or liquid ammonia. Boiling water, the concentrated mineral acids, and the heated iron, cause rapid vesication. All these applications, however, are very painful, and they can never take the place of cantharides. Perhaps the least exceptionable article of this class of vesicants is the nitrate of silver, which often blisters the skin in a few minutes, especially when it is rather delicate, and has been previously well cleansed. The remedy is particularly well adapted to infants and children, as it is never followed by sloughing and other ill effects.

(3.) *Suppurants* are the most powerful counter-irritants we possess. They are much more permanent in their character than vesicants, and are therefore more serviceable in eradicating chronic disease. As their name implies, the discharge which they produce is of a purulent nature, and hence they are sometimes described under the name of pyogenic counter-irritants. The class comprises permanent blisters, setons, and issues, which will receive particular attention in the chapter on minor surgery.

SECT. III.—CHRONIC INFLAMMATION.

Chronic inflammation is distinguished from acute by a variety of circumstances, which it is of the greatest importance to be able thoroughly to appreciate and understand. Its study, in fact, is of paramount consequence, and I am sure it is not placing too high an estimate upon its value when it is asserted that there is much greater merit in being able to diagnosticate a chronic disease, than to determine the nature and seat of an acute one. When a lesion declares itself, openly and boldly, by a well marked train of symptoms, the practitioner must indeed be ignorant, if not positively stupid, if he cannot discriminate with tolerable accuracy between it and other affections which may simulate it, or bear some resemblance to it; but it is very different when the malady is of an obscure, chronic character, lurking in the system, no one, perhaps, knowing where, even after the closest and most patient scrutiny. It is under such circumstances that the intelligent pathologist and observant practitioner often appears to the greatest advantage, by turning his knowledge to the best account for his patient.

It does not comport with the design or scope of this work to enter into any of the more minute details of this subject; a large volume might be written upon it, and even then it would not be exhausted. A mere sketch of its more prominent features is all that I shall attempt.

Chronic inflammation is of great frequency, and is liable to appear in all organs and tissues of the body; it is generally a consequence, or sequela of the acute form, but cases occasionally arise in which it would seem to be a primary affection. Strictly speaking, such an occurrence is of course impossible; all that we mean, when we use the word in this sense, is that the disease which it serves to designate is of so stealthy and insidious a character as to escape, for a considerable time, the attention both of the patient and his physician; the person is unwell, perhaps occasionally a little feverish, or the subject of headache, want of appetite, or a sallow complexion and constipated bowels; or, it may be, he has a cough, and a pain in his side; or a joint becomes sore and stiff; and still he is able to go about, and attend to business, although he is soon fatigued, and rendered uncomfortable by it. Thus a week, a fortnight, or a month may be passed, when, a careful examination being instituted, the discovery is made that there is grave disease in some important organ, and that it has perhaps already gone so far as to render recovery absolutely impossible, however skilfully the case may now be treated. The disease has been latent, or nearly so; it has failed to make itself known by any distinctive train of phenomena, and the result has been that both patient and practitioner have been lulled into fatal security. The morbid action has been lying all this time in ambush, and is now, in the true sense of the term, chronic. Such cases are by no means unfrequent, and they should serve to admonish us never to neglect any symptoms, however trivial, in our clinical investigations. A pain, a soreness, a cough, a halt in the gait, may, if properly interpreted, afford useful information in regard to the diagnosis of chronic disease, and should teach us the value and importance

of patience and caution in the examination of the sick. The slightest neglect may be fatal; a little spark may kindle a devouring flame.

Chronic inflammation, however provoked, is generally tardy and sluggish in its movements, creating little constitutional disturbance, but not, on this account, the less surely and effectually undermining the part and system. In the acute variety, the action is rapid, bold, daring; suffering is severe; and constitutional response loud and unmistakable. In chronic inflammation, on the other hand, the symptoms are, as already stated, often obscure, if not absolutely masked, and the embers of disease never break out into open flame. The disease may continue for weeks and months; now stationary, smothered, or apparently receding, and now advancing, and seemingly almost ready to assume the acute type.

The origin of chronic inflammation is often, if not generally, intimately connected with disorder of the digestive apparatus; seemingly, at all events, the first link in the chain of morbid action is frequently referable to the state of the stomach and bowels, especially to the effects of dyspepsia or constipation. Idiopathic inflammation of the eye, and other organs often owes its origin to gastro-intestinal irritation. At other times the disease is awakened by derangement of the menses, defective action of the kidneys, suppression of the cutaneous perspiration, or disorder of the biliary secretion. Anxiety of mind, grief, anger, fatigue, intemperance in eating and drinking, and inordinate sexual indulgence are all so many predisposing and exciting causes of chronic inflammation.

The effects of this form of disease are various; if not closely watched and soon checked it may prove fatal, by the induction of serious structural changes, which neither nature nor art will be able to repair. The most common and important of these changes are suppuration, ulceration, softening, adhesion, contraction, induration, and enlargement, according to the intensity of the morbid action, the texture and situation of the affected organ, and the condition of the general system. The formation of pus and molecular disintegration, whether by softening or ulceration, are exceedingly common attendants upon this variety of inflammation, and often proceed to a most destructive extent. Adhesion is most liable to occur in the serous tissues; contraction in the bloodvessels and excretory tubes. Induration and enlargement usually coexist, although occasionally they occur independently of each other. Examples of these two changes are constantly met with in surgical practice, especially in the lymphatic ganglions of the neck, axilla, and groin, in chronic disease in and around the joints, in various affections of the skin, cellular tissue, and bones, and in inflammatory hypertrophy of the tonsils, testicle, mamma, and prostate gland. When existing in a high degree, they lead to serious functional embarrassment of the affected parts, growing out of alterations of structure, which the best directed efforts of the surgeon often fail to relieve.

Gangrene, as an effect of chronic inflammation, is rare; nevertheless it is occasionally met with, as is witnessed, for instance, in the mortification of the toes and feet, so graphically described by Pott, and

dependent upon ossification and inflammation of the arteries. In most cases, when the disease passes into gangrene, it first assumes the acute type, which renders the transition much easier, and, in some degree, a necessary preliminary.

The symptoms of chronic inflammation are generally much less prominent than those of the acute variety; the pain is less, and usually also more dull or obtuse; the discoloration is dusky, livid, or purple; the swelling, often considerable, is characterized by unusual hardness, or by hardness and œdema; and the heat is nearly always less conspicuous than in acute inflammation. Functional disturbance is variable, being extensive at one time, and slight at another. Symptomatic fever may be entirely wanting, and it is this circumstance which so frequently causes this variety of inflammation to be overlooked, especially when it is of idiopathic origin. In time, the fever may assume a hectic type, or it may be of this character almost from the commencement. When the disease is extensive, or seated in an important organ, adynamic fever generally exists.

The vessels of the affected parts are generally very much dilated and distended with red and white globules, on which account the blood is propelled through them in a very tardy and sluggish manner, strikingly contrasting with the force and rapidity with which it is transmitted in the acute form of the disease, where all is power and activity, especially in its earlier stages. When the inflammation is very protracted, many of the smaller vessels have a varicose, tortuous appearance, and are so crippled as to be almost unable to send on their contents at all. Hence, congestion, often deep and extensive, is generally present, both at the focus of the morbid action and for a considerable distance around.

Treatment.—In the treatment of chronic inflammation, the indications are, first, to remove the exciting cause of the disease; secondly, to correct constitutional disorder; and lastly, to promote the absorption of effused fluids and restore the tone of the crippled and dilated vessels.

The removal of the exciting cause of the disease obviously demands the same attention here as in the acute variety of inflammation; whenever it is accessible it should be promptly disposed of. All officious interference must of course be avoided.

Restoration of the secretions constitutes a most important indication, as it is upon their derangement or suppression that the morbid action in chronic inflammation so often depends. The remedies that are chiefly to be relied upon, for this purpose, are mercury, tartrate of antimony and potassa, iodine, bromine, nitro-muriatic acid, purgatives, and a judiciously regulated diet.

In placing mercury at the head of this list of remedial agents, I am only endeavoring to show the high estimate that is so justly attached to it in the treatment of chronic inflammation. If its administration is of doubtful propriety in many cases in the acute variety of the disease, there are few instances of the chronic in which it may not be beneficially exhibited, and yet, in making this remark, it must not be understood that I would give mercury indiscriminately or sakelessly. Its value is unquestionable, but, still, there are cases and circumstances in which

it is utterly inadmissible; this is especially true of those cases of chronic inflammation which are so often met with in scrofulous children, and in persons of enfeebled and broken-down constitution, where mercury, in almost any form, is generally most pernicious, the smallest quantity sometimes producing profuse ptyalism, or gangrene of the mouth.

In administering this remedy for the cure of chronic inflammation, the surgeon has it in his power to make choice of a much greater number and variety of articles than in acute inflammation, in which he is obliged to restrict himself chiefly to calomel and blue mass. In the chronic form of the disease, he has, in addition, the bichloride, the protoiodide, cyanuret, and phosphate, which exert a most salutary influence in changing the capillary action of the part, and promoting the removal of effused fluids. Whatever substance be selected, the dose should be very small, and not repeated oftener, on an average, than twice or thrice in the twenty-four hours. The object is to produce a slow and gradual effect, and for this purpose it will generally be necessary to continue the remedy for several successive weeks. Active ptyalism is carefully avoided; it will be quite sufficient if we succeed in obtaining slight soreness of the gums. If calomel be used, a good average dose will be from one-sixth to one-half of a grain.

In children, the most suitable mercurials are blue mass, corrosive sublimate, and the hydrargyrum cum cretâ, or gray powder; given either alone, or in union with soda, soda and columba, quinine, or Huxham's tincture of bark.

Iodine and its various preparations, as iodide of potassium, iodide of iron, and Lugol's solution; bromide of potassium; barium; and tartar emetic; often exert a most salutary influence over chronic inflammation, and are particularly indicated where a slow, alterant effect is required. With the exception of mercury, I know of no article of the materia medica which produces so powerful an effect as tartar emetic in controlling chronic inflammation, and favoring the absorption of effused fluids. My practice is to give it in small doses, as the eighth, tenth, or twelfth of a grain, in combination with a little morphine, three times in the twenty-four hours.

The different acids are sometimes given with advantage, especially the dilute nitro-muriatic, which was formerly so much employed in the treatment of hepatic affections. They are particularly indicated in chronic syphilitic and scrofulous inflammations, attended with impaired digestive powers.

The bowels must be kept in a soluble condition, the nature and dose of the purgative being regulated by the exigencies of each particular case. The compound calomel pill, which, while it operates on the bowels, also excites the action of the liver and skin, constitutes one of the most eligible cathartics we possess in the treatment of chronic inflammation, accompanied with visceral obstruction.

Particular attention should be paid to the skin. This will appear the more necessary, when we consider that, in most cases of chronic disease, the perspiration is either entirely suppressed, or greatly changed in its properties. Frequent ablutions with cool, tepid or

warm water, impregnated with common salt, mustard, or potash, and followed by dry frictions, will often prove eminently serviceable. The renal secretion should also receive proper attention; sometimes elaborate chemical and microscopical examinations will be required to determine its character, and enable us to direct a suitable plan of treatment.

Exercise in the open air, either on foot, in a carriage, or on horseback, will often effect a wonderful improvement in cases of chronic inflammation, especially when of long standing, and attended with great debility. At other times, nothing but the most perfect rest will answer the purpose; as, for example, in serious disease of the brain, bones, and joints.

The subject of diet must claim special attention in the treatment of chronic inflammation. The indiscriminate use of food in this form of disease cannot be too severely reprehended. Too great abstinence, however, is often as injurious as too great indulgence. As a general rule, it may be stated that all stimulating and indigestible articles should be avoided, as being calculated to increase the local disease, and exercise a prejudicial effect upon the patient's recovery. If the system be inclined to plethora, the diet should be of a strictly farinaceous character, and be limited daily to a few articles, which may be varied from time to time as they become disagreeable to the palate, or offensive to the stomach. If, on the other hand, the patient is pale and feeble, it should be partly farinaceous, and partly animal, the meat being taken at breakfast and dinner, and its effects carefully watched. The different kinds of animal and vegetable broths, jellies, milk, arrowroot, sago, and tapioca are all eligible articles in chronic inflammation, and often prove of the greatest service in nourishing and sustaining the system. Their flavor and efficacy may be improved by the addition of spices, wine, and brandy, as may be deemed proper. When the patient is much exhausted, the use of brandy, wine, ale or porter, will often be indispensable to recovery. When marked debility exists along with emaciation, recourse may be had to cod-liver oil; rather, however, as an article of nourishment than with a view to the attainment of any alterant effect it may be supposed to possess from the presence of iodine and bromine. The dose should then be as large as may be consistent with gastric tolerance.

Finally, in the female, proper regard must be had to the state of the menstrual function; prompt measures being adopted for its improvement, or, in the event of its suppression, for its restoration. There are numerous complaints which owe their origin, either directly or indirectly, to disorder of the uterine functions.

The local treatment of chronic inflammation is often a matter of paramount importance. It comprises, first, rest and elevation of the parts, the same as in acute disease; secondly, leeching, scarification, blistering, iodine, and nitrate of silver, especially in the earlier stages; thirdly, counter-irritation by croton oil, tartar emetic, issues, setons, and the actual cautery; and, lastly, sorbefacients, such as stimulating liniments, embrocations, and unguents, the cold douche, compression with the bandage, or adhesive strips, electricity, and dry friction.

CHAPTER IV.

TERMINATIONS AND RESULTS OF INFLAMMATION.

SECT. I.—DELITESCENCE AND RESOLUTION.

These terms are used to denote the restoration of the inflamed structures to their normal condition. The word delitescence is of Latin derivation, and literally signifies to abscond; it was introduced into surgical nomenclature by the French writers, and is employed to designate the sudden disappearance of inflammation, before it has passed through its different stages, and, consequently, before it has occasioned any serious structural changes. It is unquestionably the most desirable mode of termination, and may occur either spontaneously, or from the slightest treatment. A catarrh, caused by exposure to cold, and perhaps threatening to be quite severe, often aborts during a profound sleep induced by a warm bed, or a hot foot-bath and a grain of opium. An inflammation of a lymphatic ganglion of the neck, coming on late in the evening, and attended with great tenderness on motion and pressure, together with considerable swelling, often rapidly disappears under similar measures. An incipient gonorrhœa frequently aborts under the use of a mild injection of nitrate of silver or acetate of lead; and who has not seen a bubo promptly vanish under steady, systematic compression, aided by the application of a solution of iodine? Inflammation produced by the presence of a foreign body generally rapidly disappears after the removal of the exciting cause of the morbid action.

The above facts, with many others that might be brought forward, if it were deemed necessary for my purpose, teach us two most important lessons: the first is always to remove as early as possible the exciting cause of the inflammation, and the second to enter upon the treatment of every case of the disease without the least delay. The object, invariably, should be to save structure, and the best way to do this is to make the disease abscond, or delitesce. Such an event, however, is only desirable when the inflammation can be dislodged more or less completely without the risk of throwing it upon some other and, perhaps, more important organ. Thus, an attack of gout in the great toe would be a trifling affair in comparison with an attack of gout in the heart, brain, or stomach; and hence it would be far better, where there is danger of such a translation of irritation, to let the original disease pursue its course than to attempt to arrest it by means calculated to favor such a result. A severe injection may suddenly arrest an incipient gonorrhœa, but it may do infinite harm by

the rapid induction of orchitis, which perhaps no treatment, however judiciously conducted, may be able to dispel completely under several weeks, if, indeed, under several months.

The sudden disappearance of inflammation from one structure, or set of structures, and its invasion of another, usually known by the term metastasis, suggests the importance of proper watchfulness on the part of the surgeon to prevent such an occurrence; or, if it have already taken place, to employ such means as shall be calculated to recall the morbid action as speedily and as effectually as possible to its original situation. For this purpose free use should be made of counter-irritation, in the form of stimulating embrocations, sinapisms, and blisters, aided, if the organ affected be one of great importance to life, by the abstraction of blood and full doses of opiates. If, in this way, the disease cannot be recalled, the treatment will go far to put a speedy stop to its violence and its tendency to extend its influence.

The term resolution denotes the gradual dissipation of inflammation after the disease has made some progress and done some mischief, but before it has reached the suppurative crisis, or committed such ravages as to prevent the affected tissues from regaining their original properties. With such an issue effusion of serum and lymph is not at all incompatible, as these fluids may be entirely absorbed; a similar remark is applicable to pus, provided it exist in small quantity, and not in the form of an abscess, in which there is always more or less waste of tissue; and even to pure blood, which, if not too abundantly effused, or deprived of vitality, is generally readily amenable to the action of the absorbents.

When resolution is about to occur there is a gradual and steady subsidence of the morbid action, as denoted by the changes in the local and constitutional symptoms. The discoloration, heat, pain, and swelling become less and less in consequence of the contraction of the vessels and the absorption of the effused fluids; the febrile disturbance goes off; and the part and system, no longer feeling the effects of the disease, at length regain their former condition. Often many weeks, and even several months, elapse before the restoration is finally completed. The absorbent vessels, kept in abeyance by the vascular action and the effused fluids, are slow to resume their functions; they act at first hesitatingly, as if afraid to enter upon their labor, but as the work progresses they acquire confidence, and, at length, setting about it in good earnest, they ere long finish their task, drinking in, as it were, all that their oppressors, the secernents, had previously poured out, and thus leaving the parts in a condition to regain their primitive characters. The bloodvessels usually remain dilated, feeble, and sluggish for some time after the complete subsidence of the disease, and there is also frequently more or less perversion of special sensation.

SECT. II.—DEPOSITION OF SERUM.

A deposition of serum, or of the watery elements of the blood, is a common attendant upon inflammation, and in some cases constitutes

the principal, if not the only evidence of its presence. The structures which supply it in greatest abundance, when thus affected, are the cellular and serous, the secernent vessels of which are generally extremely active, even when the disease is comparatively mild. Large quantities of serum are also occasionally poured out by the mucous membrane of the alimentary canal, especially by that of the colon and rectum, as is observed in certain forms of diarrhœa and infantile cholera. Inflammation of the skin, unless produced by scalds, blisters, erysipelas, and the various bullar diseases, yields this fluid generally very sparingly. Very little is also effused in inflammation of the muscles and fibrous membranes, the nerves and vessels; while tendon, cartilage, and bone do not afford any, however severe the lesion. A similar remark is applicable to inflammation of the parenchymatous and glandular organs, as the lung and liver. In the cellular tissue serous accumulations are particularly liable to occur wherever this substance is most loose and abundant; hence they are very common in the eyelids, scrotum, prepuce, labia, nymphæ, legs and feet, which are often enormously distended in consequence. Œdema of the glottis is an example of watery deposit in the submucous cellular substance of the edges of the windpipe. In the splanchnic cavities and the movable joints serum often collects in immense quantities; sometimes as an effect of acute, but more frequently as a result of chronic inflammation.

Particular epithets are employed to designate certain collections of serum, based either upon the appearance of the part, or the anatomical name of the cavity which serves to receive the fluid. Thus we are in the habit of speaking of œdema of the glottis, œdema of the eyelids, and œdema of the legs, simply because these structures, when thus affected, have a swollen, glossy aspect. The older writers applied the word anasarca to all aqueous accumulations of the inferior extremities, as the appearance thereby produced bears some fancied resemblance to a mass of flesh. Dropsy of the legs is another familiar expression intended to designate the same thing. The latter term, however, is generally restricted to the collections of serum in the various cavities of the body. Thus, when we speak of water in the peritoneum, we say that the individual has dropsy of the abdomen, and so of the chest, head, pericardium, joints, and vaginal tunic of the testicle. Or, instead of this term, we use a Greek one, either simple or compound, as being somewhat more classical. In this manner a dropsy of the abdomen becomes an ascites; of the chest, a hydrothorax; of the head, a hydrocephalus; and of the vaginal tunic, a hydrocele.

The appearance of the serum is generally limpid, but cases occur in which, from the admixture of extraneous matter, or hematin, it is yellowish, milky, or even quite dark. The latter appearance is generally present in the peritoneum in strangulated hernia, and is to be viewed as an evidence of intense inflammation. A similar phenomenon is witnessed in the blebs of incipient gangrene, and in the enormous serous accumulations which occasionally occur in the limbs in consequence of snake bite and other severe injuries.

The fluid occasionally contains flakes of lymph, pus, and pure blood, although the latter is uncommon. It is often quite unctuous to the touch, is saline in its taste, but free from odor, and is readily coagulable by alcohol, acids, and corrosive sublimate; circumstances which show that it is composed principally of albumen, in combination with some of the earthy salts, especially the sulphates. Its quantity in acute inflammation is usually small, except in the splanchnic cavities, where it is sometimes immense, amounting to many quarts, or even several gallons. Under such circumstances, too, it always contains more or less fibrin.

Much diversity of sentiment has been expressed in relation to the kind of action by which this fluid is produced; some declaring that it may be deposited without the aid of inflammation, while others maintain that it is invariably the result of this morbid process. I have long been impressed with the truth of the latter doctrine, and have strenuously advocated it in my writings, as well as in the lecture-room, for the last twenty-five years. I cannot, indeed, see how it is possible to reach any other conclusion, unless we assume, which, however, I am not inclined to do, with certain pathologists, that there is no real or genuine inflammation without suppurative action, or, at all events, plastic exudation. Such a doctrine as this would, of course, be fatal to the idea that serous effusion is a result of inflammation. But these pathologists, notwithstanding their attempts at theorizing, are well aware that inflammation often, if, indeed, not generally, proves fatal long before it reaches this height. There is, therefore, but one alternative in regard to this question; we must assume either that there may be inflammation without exudation of fibrin and the formation of pus, or that thousands of persons daily perish without any disease whatever, simply from perverted nutrition, or functional disorder. To entertain such an opinion would be absurd, and we are therefore forced to the conclusion that, whenever there is an effusion of serum, such an effusion is denotive of the existence of inflammation, even when there has been no tangible evidence of the ordinary phenomena of the disease, as heat, pain, and discoloration. We have an illustration of this fact in chronic dropsies, where the inflammation is often so extremely mild that, save the mechanical inconvenience which the fluid occasions, the patient is hardly conscious of any suffering whatever. Yet even in such cases it will generally be found, on dissection, that the serous membrane which furnished the water, exhibits sufficient indication of the lesion, as afforded by the opaque and thickened condition of its substance. It may be questioned whether mere congestion is capable of producing serous effusion. At first sight such an occurrence would seem to be quite probable; but a careful examination of the subject soon dispels the illusion. Permanent obstruction of the abdominal cava will cause ascites; not from congestion of the vessels of the peritoneum, but as a consequence of its inflammation, the result of the previous vascular engorgement. It is easy to see that vessels habitually distended, must soon take on incited action, followed by abnormal deposits. A familiar illustration of this is afforded in the conjunctiva, where, if the vessels are at all engorged even for a short time, inflam-

mation is sure to follow, unless the exciting cause of the determination be removed. If this mode of reasoning be correct, it follows that obstruction of the circulation, however induced, will, if permitted to continue, be soon succeeded by inflammation, of a grade and character sufficient to cause at least an effusion of serum, if not also of other fluids.

Of the nature of the morbid action, when serum is rapidly supplied, or when it is associated with other deposits, as lymph or pus, there can be no doubt; it is eminently inflammatory, and nothing else. The concomitant symptoms, and dissection after death, clearly establish the fact. The rapid and profuse serous exhalations which occur in acute pleurisy, peritonitis, and arachnitis admit of explanation in no other way; they are the appropriate products of these structures, and hence they are generally poured out quite early in the disease.

Effusion of serum is often associated with, if not remotely dependent upon, an impoverished and watery condition of the blood, accompanied by a marked decrease of fibrin and red particles. If, under such circumstances, inflammation be lighted up in almost any of the tissues, especially the cellular and serous, serum cannot fail to be supplied in large quantities, since, in consequence of the diminution of the plastic properties of the blood, there is nothing to restrain its exudation. Hence such action is very prone to be followed, externally, by anasarca, or œdema, and internally by dropsy.

The *symptoms* produced by this deposit are such, mainly, as are denotive of mechanical obstruction. In the eyelids, scrotum, prepuce, vulva, glottis, and legs, it is marked by a soft, inelastic swelling, which pits on pressure, and imparts a peculiar glossy appearance to the affected surface; attended, especially in the inferior extremities, with pain, heat, and more or less discoloration, usually of a pale dusky hue. A sense of distension is also commonly a prominent symptom. In œdema of the glottis there is serious impediment in the respiratory function, while in accumulations of water in the splanchnic cavities there must necessarily be more or less oppression, with displacement of the contained viscera. A large collection of water in the chest may not only cause collapse of the lung on one side, but greatly encroach upon the opposite one, and at the same time throw the heart completely out of its natural position, depress the diaphragm, and tilt up the intercostal spaces so as to give the thorax a vaulted configuration. In infiltration of the cellular tissue of the legs, feet, scrotum, and vulva, the fluid may, by its pressure upon the capillary vessels, cut off the supply of blood from the skin, and thus become a source of mortification, as we see exemplified in erysipelas and anasarca.

Treatment.—In the treatment of serous effusions, the main indication is to promote the absorption of the offending fluids by the use of hydragogue cathartics, diuretics, and mercurials; followed, when these means fail, by a puncture for their efficient evacuation. The most important cathartics, after thorough purgation, are jalap and bitartrate of potassa, citrate of magnesia, and elaterium, given in doses proportioned to the strength of the patient and the tolerance of the stomach and bowels. These remedies, as well as others of a kindred nature, produce

their beneficial effects by establishing a drain upon the serous capillaries of the alimentary canal, which leads indirectly to the absorption of the serous accumulation. When mercurials are required, as they will be when there is obstruction of the portal circle, with deficiency of the biliary secretion, the most eligible articles will be calomel, blue mass, or corrosive sublimate, either alone or in union with elaterium, squills, digitalis, or antimony, according to the nature of the collateral disorder. Deficiency of the renal secretion must be met by suitable diuretics.

When the accumulation of serum is very great, as in cases of dropsy of the chest, abdomen, or pericardium, all internal treatment will be likely to prove abortive, from the fact that it is generally impossible, under such circumstances, to arouse the absorbents to a sense of their duty; the pressure of the fluid keeps them in a crippled and paralyzed condition, altogether incompatible with the healthy exercise of their functions. Hence, instead of wasting our time and the strength of our patient, as is unfortunately too often done in such cases, early recourse should be had to an operation with a view of affording vent to the pent-up matter. I am certain, from frequent observation, that serious and even fatal errors are constantly committed by practitioners from their indisposition to early interference with the trocar in these accumulations. They forget that their purgative, diuretic, and alterative remedies, if available at all, can prove beneficial only at the expense of much distress and exhaustion of the system, which too often leave the sufferer, in the event of his recovery from the disease, with shattered and broken health for years afterwards, if not during the remainder of his life. An operation, on the other hand, generally affords prompt and efficient relief to the urgent symptoms, and places the part in a condition to be influenced by sorbefacient measures.

Local remedies are available chiefly in serous effusions in the external parts of the body. In œdema of the extremities vast benefit is often derived from steady and persistent elevation, and regular, equable compression with the bandage, extending upwards from the distal portion of the limb. In this way support is given to the capillaries, while a salutary stimulus is imparted to the absorbents, well adapted to rouse them into action. This treatment often derives important aid from frictions with sorbefacient unguents, liniments, and embrocations, and the application of the dilute tincture of iodine. When the distension is inordinate, or threatens to eventuate in gangrene, early punctures and even free incisions are called for. In œdema of the glottis nothing short of prompt and decisive scarification will prevent suffocation.

SECT. III.—LYMPHIZATION, OR FIBRINOUS EXUDATION.

Lymphization is the act of separating lymph from the blood and depositing it into the organs and tissues, or upon their free surfaces. The term, which I was the first to introduce into science, has been objected to, on the ground, as is alleged, that it is not well chosen,

because the word lymph is given to the fluid contained in the lymphatic vessels. I can perceive no reason, however, why it should not be retained and generally adopted, for it is certainly quite as appropriate and classical, in reference to the substance which it serves to designate, as the word suppuration is in relation to pus, which is the product of that act. I am the more inclined to this view, seeing that the word "lymph" is still in general use, notwithstanding the attempts that have recently been made to discard it by substituting the term "plasma," which is, if possible, still more objectionable. Perhaps the least obnoxious term is "fibrin," which is now also much in vogue, and which is expressive of at least one of the most important attributes of that substance, namely, its chemical constitution. The phrase "plastic matter" would be very appropriate, were it not that it is too circuitous for easy use.

There is rarely any inflammation, however slight, in which there is not some deposit of lymph. Indeed, in many cases, and in certain situations, it constitutes almost the only product of the morbid action. Thus, in croup and peritonitis, the chief evidence of the existence of these diseases, after death, is the presence of lymph; in general, however, it is associated with other deposits, especially serum, which is often poured out along with it in large quantities. When the inflammation is at all severe, and particularly if it has already made considerable progress, there may be, in addition, puriform matter, pus, and even pure blood. Its presence, whether occurring singly or combinedly, is always, as a general rule, denotive of a higher grade of action than the mere effusion of serum.

The capacity of furnishing lymph, in inflammation, is possessed in different degrees by different organs and textures, depending upon the peculiarities of their organization. It is always, other things being equal, poured out most freely by the serous membranes, especially the pleura and peritoneum, by the cellular tissue, and by certain portions of the mucous system, as the faucial, laryngeal, intestinal, and uterine. Very little is effused, under any circumstances, by the fibrous membranes, the muscles and their tendons, the vessels, nerves, cartilages, and bones, except in cases of fracture and other injuries, when it is sometimes thrown out in great abundance. In the parenchymatous organs, the same diversity obtains in respect to this deposit as in the tissues, properly so called. In some, as in the brain, liver, and kidneys, it is usually supplied very sparingly, whereas, in inflammation of the lungs and spleen, it is often effused quite freely, leading to rapid solidification of their proper structure. Large quantities of lymph are sometimes exhaled during the progress of abscesses, many of which it serves to inclose in a distinct cyst, known as the pyogenic membrane.

The deposit of lymph generally begins soon after the inflammatory action, and often continues for an indefinite period, increasing and declining with the disease. It is surprising how soon it sometimes shows itself. From my experiments upon inferior animals, as well as from my observations upon the human subject, I have been led to believe that it generally begins much sooner than is commonly

supposed. In 1841, I had occasion to see repeated proofs of this fact, while engaged in an elaborate series of experiments upon dogs, with a view of elucidating the nature and treatment of wounds of the intestines. I found, in many of these animals, that the bowels had become extensively adherent, not only to each other, but likewise to the walls of the abdomen, within the space of a very few hours after the operation. In the case of a gentleman whose abdomen I opened some years ago, on account of a twist in the small intestine, I ascertained that, although death happened at the end of four hours, nearly the whole peritoneum, visceral and parietal, was coated with a thin film of fibrin, of which hardly any traces existed anywhere at the time of the operation. In another case, that of a young lad, who died within nine hours after he had been shot in the side, the ball wounding the abdomen, diaphragm, and chest, large quantities of lymph were seen both upon the peritoneum and pleura. The flaps made in amputation become speedily glazed with fibrin, and a similar phenomenon is often witnessed upon incised wounds, the edges of which frequently adhere quite firmly within a very short time after the application of the dressings.

From the preceding facts, it may be concluded that the process of lymphization generally begins at an early period of the inflammation, and that, if the circumstances are at all favorable, it proceeds with great vigor. If the reverse, however, be the case, then it goes on comparatively slowly, or it may even fail entirely. Such an event will be most likely to happen in low and depraved states of the system, attended with an impoverished condition of the blood, and consequent lesion of the innervation.

Lymph, fibrin, or plasma exhibits, when first effused, a whitish, pale straw, or opaline appearance, though occasionally it is somewhat reddish, from the admixture of hematin. In cases of protracted jaundice, I have occasionally found it of a pale-orange hue. It is of a soft, unctuous consistence, like hot glue, or a thin solution of starch, without smell, and of a faint saline taste. Its chemical constitution is fibrin, in union with albumen and serum. Immersion in alcohol renders it tough, and changes its color from white to buff.

Examined *microscopically*, lymph is seen to consist of numerous globules, of a spherical shape, nearly homogeneous, and about the $\frac{1}{2500}$ of an inch in diameter. Delicate fibrils, straight, parallel, and interspersed with innumerable granules, are also visible in it. It is derived directly from the blood by a process of secretion, and is identical with the buffy coat and the blood-liquor; possessing vital and organizable properties, and capable, therefore, of performing important duties in the economy. Being always deposited in a fluid state, it soon arranges itself in various forms; now as an amorphous mass; now as a tube, as in the larynx, and bowel; at one time as a lamella, and at another as a distinct band; its conformation being materially influenced by that of the organ, tissue, or cavity in which it is effused.

Lymph does not always exhibit the same appearances under the microscope any more than it does under the naked eye. In this respect it shares the same fate as other morbid products. I cannot, therefore,

recognize the doctrine of an essential difference in the character of the effused substance, so strenuously maintained by some recent pathologists, believing, as I do, that this difference is entirely due to a difference in the state of the part and system in different individuals, localities, and grades of the morbid action. Corpuscular lymph, as it has been termed, differs from ordinary lymph only, or chiefly, in having a greater number of exudation globules, and less of healthy fibrin. Hence, it is generally met with in persons of deficient vital powers, with an impoverished state of the blood, and usually manifests a disposition to break down and become effete.

Fig. 7 displays a portion of recently-effused lymph, opaque, white-colored, friable, and magnified about 380 diameters, from an inflamed pleura. It is composed of globules, smaller molecules, and granular matter in a hyaline matrix. In the lower part of the figure the granules and molecules are shown as floating in serous fluid. In fig. 8, the structure of the effused matter is somewhat

Fig. 7.

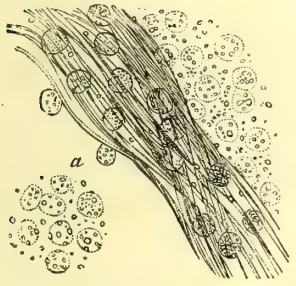


Fig. 8.

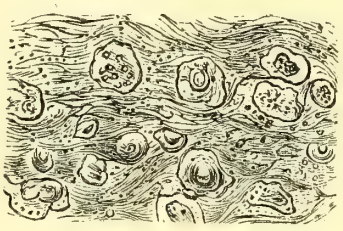


Fig. 7. Plastic corpuscles and filaments in recent lymph exuded on the pleura. *a*. The corpuscles, unchanged by acetic acid. (BENNETT.)

Fig. 8. Recent lymph, forming false membrane.

different. It forms, in fact, a sort of false membrane, magnified 800 diameters. Numerous corpuscles are seen, more or less globular, and having the character of primary cells; the intervening texture is formed of most delicate fibrils. A few minute granules are interspersed through the tissue.

The period at which the organization of this substance takes place varies with a number of circumstances, of which the most important are, the plasticity of the effused matter, the nature of the affected tissue, and the state of the general system. To enable it to attain this point at all it is necessary that it should have a strong cell-life, or cell-force; for when this is wanting the development of cytoblasts and nuclei is either impracticable, or it occurs so imperfectly as to be soon arrested, or, at all events, very much impaired in its strength. When everything is favorable, the development proceeds very rapidly; cells and nuclei are formed in great numbers, and these, connecting themselves with each other, are gradually spread out into fibres, lying, for the most part, in straight, parallel lines, and profusely inlaid with granules, as in fig. 9. Soon after this process has begun, vessels show

themselves in the new product, being the result either of a new epigenesis, or derived from the neighboring structures, the latter being by far the more common source of the supply. The walls of the vessels are, at first, as might be supposed, very frail and yielding, so that the

Fig. 9.

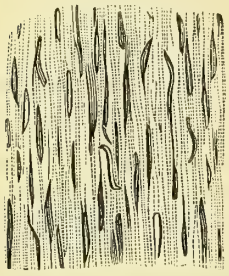


Fig. 10.

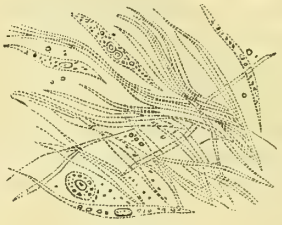


Fig. 11.

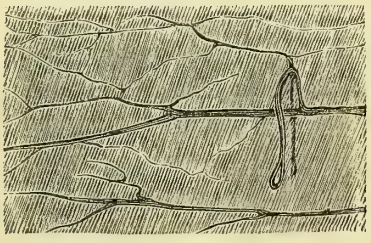


Figs. 9 and 10, from Bennett, show nuclei and cells developing themselves into fibres: whilst fig 11 exhibits a perfect fibrous tissue.

least possible pressure is sufficient to rupture them and cause an extravasation of their contents. In proportion, however, as they increase in strength, they become better qualified for the discharge of their functions, and in time they acquire all the properties of the natural vessels. When fully developed, they can be easily discovered with the naked eye, and readily admit fine injecting matter. The veins are usually disproportionably large to the arteries, but this defect also disappears in time. To render the organization complete, nerves and absorbents are necessary, and these are accordingly soon supplied, but whether by the surrounding tissues, or by the inherent powers of the effused matter, observation has hitherto failed to determine.

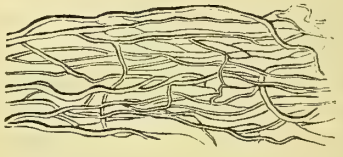
The arrangement of the newly-formed vessels is represented in the annexed sketches. Fig. 12 is a portion of coagulating lymph attached by a narrow neck to the peritoneal coat of an inflamed intestine. The vessels have a ramiform disposition, and freely anastomose with each

Fig. 12.



Newly-formed vessels in plastic lymph.

Fig. 13.



Vessels in false membrane of the pleura.

other. Fig. 13 is a piece of false membrane of the pleura. The vessels are large, numerous, and farther advanced than in the other sketch.

There are some situations where fibrin is never organized, however

strong its vitality may be at the moment of its deposition. Such an occurrence, for example, is nearly always impossible in the alimentary canal and urinary bladder, for the reason that the irritating and heterogeneous contents of these reservoirs speedily deprive the lymph of its organizable properties. Site, then, exercises an important influence upon the process, which, it may be added, is also materially affected by the state of the blood and solids; the more feeble and impoverished these are, the less likely will the effused substance be to form cells and nuclei, vessels, nerves, and absorbents.

Lymph is susceptible of absorption both in its fluid state and after it has been changed into blastema and fibro-cellular tissue. This, however, does not occur, at least not to any extent, during the height of the inflammation, by which it has been produced; on the contrary, there must always be a marked reduction of the morbid action before the absorbent vessels can be induced to take hold of it; but when this point has once been reached, the process often goes on very rapidly, as is witnessed in fractures, dislocations, wounds, and other injuries, in which the swelling, chiefly caused by fibrinous deposits, occasionally completely vanishes in a few days. The absorption will of course be more difficult when the lymph has become organized, when, in fact, it not unfrequently effectually resists all the efforts that the surgeon can employ to get rid of it. The opaque spot on the cornea often remains despite of the most protracted treatment. It is probable that lymph, before it can undergo absorption, even in its liquid state, is broken up and dissolved in the fluids of the affected parts; being thus brought more readily under the influence of the vessels.

Moreover, lymph is susceptible of various kinds of degeneration, both in its early and in its more advanced stages, just like other deposits and formations. When recently effused, it may be converted into pus, especially when it is aplastic and exposed to the air; under which circumstances it also frequently becomes hard, dry, and shrivelled, losing its vitality, and assuming the character of an effete substance. It also undergoes fatty degeneration, both before and after vascularization; and, finally, there are cases in which it becomes the seat of pigmentary deposits.

1. USES OF PLASTIC MATTER.

The uses of coagulating lymph in the repair of disease and injury were very imperfectly understood by the older surgeons, and hence it is not difficult to account for their erroneous principles of treatment. A few only had any correct notions on the subject, which, however, strange as it may appear, they rarely applied in practice. Taliacotius, although he knew how to reconstruct mutilated parts, by the transplantation of integument from one region of the body to another, seems never to have thought of applying the knowledge thus acquired to the reunion of accidental wounds. Instead of approximating their edges and keeping them together for a certain period, to insure their adhesion, the older surgeons not only allowed them to gape, but took great pains to irritate and inflame them, thinking thereby to rid the part and sys-

tem of noxious humors. No person with such an injury was deemed safe until the parts had passed through a process of mundification, suppuration, and incarnation. To treat them otherwise would, in their judgment, have subjected them to great hazard, on account of the supposed retention of peccant matter. An opportunity must be afforded for this to escape, and the period consumed in this delusive treatment often extended through several months even in the most insignificant cases. Wounds which, if properly managed, would have healed in a few days, were thus often kept open for an incredible length of time. This practice, so prejudicial to the true progress of surgery, and so utterly at variance with the best interests of humanity, continued in vogue until the time of John Hunter, towards the close of the last century. It remained for this illustrious man to point out the properties of plastic lymph, and to describe its many surgical uses. Through his influence a happy revolution has been effected in the treatment of wounds and other injuries, as well as in the various plastic operations, the beneficial effects of which cannot even yet be fully estimated.

The modern practice in the treatment of wounds is, as soon as all oozing of blood has ceased, to approximate their edges by appropriate dressings, and to retain them in this position for a sufficient length of time to insure their reunion by the organization of the plasma that is effused between them. But little inflammation is required for the process, and hence the chief duty of the surgeon consists in keeping the parts cool, at rest, and in an elevated position. The great danger is in doing too much, thereby thwarting nature's efforts at repair. All heating and stimulating applications are out of the question, as so many impediments to the desired action; the mind and body are kept free from excitement, and the strictest attention is paid to the bowels, diet, and secretions; under this management the wound generally heals in a few days, the bond of union becoming hourly firmer and firmer until it is as perfect as nature can make it by the conversion of the plasma into fibro-cellular matter, of which, however, very little is ordinarily left when the process is completed.

Parts completely separated from each other, and immediately replaced, will, if judiciously managed, often reunite, and be nearly, if not quite, as useful as before. Numerous cases, of a well authenticated character, are upon record of bits of fingers, the nose, and the ear having been successfully treated in this wise.

It was upon a knowledge of the plastic properties of coagulating lymph that Taliacotius founded his world renowned operation, which is now universally known by his name, of repairing mutilated noses, lips, and ears. His attention was originally directed to the subject by watching the effects of the grafting of trees; he observed that the transplanted portion not only contracted firm adhesions in its new situation, but that it generally grew with great vigor, and ere long produced most excellent fruit, altogether superior to, and different from that of the parent stock. Possessed of a profoundly inventive genius, he was led to believe that a similar operation might be performed upon man, and it was not long before he put his reasoning to the test of experi-

ment. His success was complete, and the result was that he became the great rhinoplastic surgeon of his day. His method consisted in raising a flap of integument from the arm, and after having thoroughly pared the mutilated organ, in sewing the raw edges accurately together, care being afterwards taken to maintain the parts in contact with each other until they had become closely and inseparably united. The Indian method, as it is termed, differs from that of Taliacotius mainly in this, that the flap of skin is generally borrowed from the immediate vicinity of the deformed organ, its pedicle being twisted upon itself in such a manner as not to interfere injuriously with its circulation.

Du Hamel, near the middle of the eighteenth century, executed some curious experiments, which, as having a direct bearing upon the present subject, deserve passing notice, notwithstanding they are old and trite. They consisted in ingrafting the spur of a cock upon the comb of the same animal, where, especially if the spur was a young one, it generally promptly united. In one instance he found that the spur, although not larger than a hemp-seed, when the operation was performed, acquired in the course of from three to four years a length of several inches. The experiment was subsequently repeated by John Hunter, with similar results. He ascertained not only that what Du Hamel had said was perfectly true, but that, if the testicle of a cock be transplanted into the abdomen of a hen, such complete union will occur between them as to permit minute injecting matter readily to pass from the vessels of the one into those of the other.

The fact that a tooth, extracted by mistake, will, if immediately replaced in its socket, speedily reunite, and ultimately regain its former hold, has long been familiar to dentists. It was formerly supposed that the adhesion was always imperfect, but that this is not so is shown by the circumstance that the vascular connection between the tooth and the socket may be demonstrated by injection. The knowledge of this fact led to the painful and disgusting practice, so much in vogue in the last century, of transplanting teeth from the mouth of one person into that of another, and which was finally abolished only when it was discovered that it was fraught with danger, on account of its liability to transmit disease.

Finally, there is, as an additional illustration of this interesting subject, the singular experiment of John Hunter of inserting a fresh human tooth into the comb of a cock, where it took root, and became firmly fixed, new vessels extending up into the cavity of the fang, as was ascertained by injection after the death of the animal.

Curious and instructive as the above experiments are, they hardly equal, in point of interest, many of those that have been performed by the modern surgeon upon the human subject for the relief of mutilated structures. Whether science has attained its highest triumphs in the department of plastic surgery, or whether it is capable of still further achievements, time alone can determine.

The good effects of plasma are exhibited in various other processes, as in the suppression of hemorrhage, and the radical cure of hernia. In the former, the patient would inevitably bleed to death if it were not for the agency of lymph in sealing up the mouth of the vessel by

attaching the internal clot firmly to its surface. In hernia a radical cure can only be effected through the intervention of plastic matter, thrown out in consequence either of the pressure of a well-adjusted truss, or the injection of some irritating fluid, causing inflammatory action in the parts around.

Plastic matter is often of service in circumscribing morbid action, and in inclosing foreign bodies. In abscess a wall of lymph is generally formed around the pus, effectually preventing its diffusion among the surrounding tissues. Occasionally the fluid is inclosed by a distinct membrane, derived from the fibrin of the blood, and possessed of a high degree of organization. In carbuncle and erysipelas the lymph is usually of an aplastic nature, and therefore incompetent to prevent the extension of the disease. Balls, needles, pins, and various other foreign bodies are occasionally inclosed in a manner similar to pus, and, in consequence, often remain harmless tenants of the body for many years.

Again, plasma is of service in obviating accidents. Thus, in abscess of the lung, if it were not for the intervention of the fibrin of the blood, the matter would often break into the cavity of the chest, and destroy life in a few days, if not in a few hours. How then is this untoward occurrence prevented? Simply by the development of inflammation in the pulmonary pleura, followed by a deposit of lymph, which thus becomes the bond of adhesion between this membrane and the costal pleura; so that by the time the matter reaches the surface an effectual barrier is opposed to its effusion, in consequence of which it generally discharges itself through a contiguous bronchial tube. A similar occurrence takes place in abscess of the liver in relation to the peritoneum and intestinal tube. In typhoid fever the glands of Peyer are often perforated, and yet it seldom happens that the contents of the bowel escape into the abdominal cavity, simply because of this wise provision of nature in gluing together the contiguous serous surfaces.

Finally, lymph is of use in obliterating serous cavities. In the radical cure of hydrocele, a disease which has its seat in the vaginal tunic of the testicle, an operation is performed which has for its object the establishment of a certain degree of inflammation, followed by a deposit of fibrin, just sufficient to cover the opposing surfaces, and to insure their permanent agglutination. Serous cysts are treated upon similar principles; and modern surgery has been emboldened to inject even some of the movable joints, the abdomen, and ovarian tumors with irritating fluids, for the radical cure of dropsical diseases of these parts.

2. INJURIOUS EFFECTS OF PLASTIC MATTER.

But lymph is capable of producing injurious effects as well as beneficial; nature's operations cannot always be controlled by art, and it is, therefore, not surprising that she should often overleap the bounds of discretion when she is depleting the inflamed structures by effusion of plastic matter. Immense mischief is frequently done in this manner, within a few hours after the commencement of the morbid action;

mischief which it may require months of the most judicious and persevering efforts of the surgeon to eradicate. Examples of this occurrence are daily met with in practice, and serve as mortifying illustrations of the impotency and imperfection of our art, as well as of the perverseness of disease.

Among the more common and obvious effects of this description are the following: 1. Mechanical obstruction of the natural outlets of the body. 2. Change of structure, by interstitial deposits. 3. Abnormal adhesions. 4. Induration and enlargement.

a. An example of *mechanical obstruction* from a deposit of lymph is afforded by what occurs in the windpipe in plastic croup, the principal anatomical character of which is the formation of a false membrane, which often moulds itself accurately to the shape of the tube, and which, especially when it extends high up into the larynx, may become a source of suffocation by impeding the entrance of the air into the lungs. In rare cases the membrane is detached and expectorated; but generally it remains in spite of our remedies, and speedily destroys the patient. Not even an artificial opening into the trachea will usually avert this event.

In some of the mucous canals this matter is poured out beneath the lining membrane instead of upon its free surface, where, becoming organized, it leads to permanent contraction of the tube. It is in this manner that stricture is formed; when the case is a very bad one, lymph may also be effused into the substance of the lining membrane, and even upon its free surface, as is seen in what is called the bridle-stricture of the urethra, which, however, is exceedingly rare.

b. Change of structure by *interstitial deposit* of lymph occurs in almost all cases of inflammation, however slight or however situated. In pneumonitis, it closes up the air-cells and minute bronchial tubes, as well as the cells of the connective areolar tissue, producing what is called hepatization of the lungs. Opacity of the cornea, acting obstructingly to the rays of light, is the invariable result of a deposit of plastic matter either beneath its conjunctival covering or in its inter-lamellar structure.

c. Abnormal adhesions, wherever found, are occasioned by this substance, thrown out as a consequence of inflammatory action. The effects of such adhesions are always more or less prejudicial. In the thoracic cavity, they confine and restrain the play of the heart and lungs; in the abdomen, they often become a source of internal strangulation; in the mucous outlets, as in the vagina and uterus, they may produce complete occlusion of their orifices; and in the vessels, especially the arteries, they sometimes induce obliteration of the largest sized trunks. Abnormal adhesions between the bowel and the sac in hernia are sometimes a cause of its irreducibility.

Great mischief is often done by deposits of lymph into the joints. If the matter be not promptly removed by the absorbents, nature makes an effort to organize it, and to convert it into an adventitious structure, which, undergoing various mutations, at length assumes the properties of the osseous tissue, at the same time that it effectually destroys the motions of the articulation. The case, in fact, is one of

bony anchylosis, and no treatment that can be brought to bear upon it will be of any avail in regaining the functions of the part.

d. Among the more frequent and distressing evils of plastic deposits are *induration and enlargement*, or hardening and thickening of the organs and tissues. Such occurrences are generally exceedingly annoying, often severely taxing the patience of the sufferer and the skill of the professional attendant. They are the direct result of interstitial deposits, which often manifest an early tendency to organization and transformation, and which none but the most determined perseverance in the use of remedies can enable us ultimately to overcome. The stiff and thickened joint, the indurated and enlarged testicle, the hypertrophied spleen, liver, and lymphatic gland, the hardened and enlarged tonsil, are literally living witnesses to the truth of this statement.

TREATMENT.

The treatment of lymphization is to be conducted upon general antiphlogistic principles; undue action is to be repressed, and the absorption of effused matter is to be promoted. To accomplish the first of these objects, the ordinary local and constitutional measures are employed; for the second, sorbefacients are necessary, as mercury and iodide of potassium internally, and the tincture of iodine, liniments, and embrocations externally. In the acute stage of the disease, while secretion is still active, purgatives and antimonials, with the liberal exhibition of calomel, constitute the chief means of relief; but the tendency to deposit having ceased, their use is dispensed with, all except the mercury, which is now given in minute doses, and with a view strictly to its alterative effect; it is often carried to slight ptyalism, the mouth and gums being maintained in a tender condition for perhaps several weeks consecutively; or, with an occasional interval, for even a much longer period. In the latter event, the bichloride frequently, if not generally, forms a valuable substitute for the calomel; less likely to act hurtfully, and yet, at the same time, more effectually stimulating the absorbents. In such cases, too, small doses of tartar emetic often produce a most salutary influence; its action being hardly inferior to that of mercury itself, with which it may frequently be advantageously combined. When the inflammatory action has pretty much subsided, its products, especially the serous and plastic, are generally easily gotten rid of by hydrochlorate of ammonia, or iodide of potassium, administered in doses varying from three to twenty grains, in aqueous solution, three times in the twenty-four hours; strict attention being paid, meanwhile, to the diet and bowels. When the case is obstinate, an occasional mercurial will constitute a valuable addition.

Among the more beneficial topical means are, the dilute tincture of iodine, applied twice in the twenty-four hours; inunctions with mercurial and other unguents, particularly that of the iodide of lead; stimulating embrocations; and steady, uniform support with the bandage. Various kinds of plasters, as the common mercurial, the compound galbanum, and others of a kindred nature, are also frequently

serviceable. Washing the part well, when accessible, twice a day with hot water and Castile soap, and then using dry friction upon it, often do more good than anything else. In some cases, again, cold, especially in the form of the douche, acts very beneficially, affording relief when everything else seems to fail. In the case of the joints passive motion must be carefully performed, at first once, and then twice a day, to prevent anchylosis from the organization of the fibrinous bands which are so liable to form during the progress of synovitis.

When the object is simply to assist nature in her efforts at repairing injury, as a wound or fracture, care should be taken, on the one hand, that the attendant action is not too low, and, on the other, that it does not transcend the fibrinizing limits. By over-officiousness the system may be so exhausted as to render the proper supply of lymph in the part a matter of impossibility, or such a state of the constitution may be brought about by the effects of previous disease, intemperance, or inadequate nutrition from the want of proper food. However induced, it should claim prompt attention, every effort being made, by the use of tonics, stimulants, and other invigorating measures, to supply the blood with the requisite material for the deposition of fibrin; all debilitating topical applications being at the same time discontinued. Over-action, on the contrary, is met by the usual antiphlogistic means, carefully and warily applied, lest harm should result from the too rapid reduction of the vital powers. The management of the reparative process always demands great judgment and vigilance.

SECT. IV.—SUPPURATION AND ABSCESS.

Suppuration is the process by which pus is formed, and is one of the most frequent, as it is certainly one of the most important, of the results, events, or conditions of inflammation. Its presence, as a general rule, is denotive of a higher grade of excitement than a mere deposition of serum and plastic matter, which, however, are nearly always associated with it. But it must not be supposed that the reverse of this proposition is true; for inflammation often exists in a severe degree, with an abundant effusion of the watery and fibrinous elements of the blood, and yet there is not the slightest evidence of suppuration.

It was formerly supposed that suppuration might occur without the agency of inflammation, and there seems to be still a lingering disposition on the part of some pathologists to adhere to this doctrine, if not by direct advocacy, at least by implication. The opinion doubtless had its origin in the fact that there are occasionally cases of suppuration in which large quantities of pus are thrown off, without any evidence of the ordinary phenomena of inflammation, such, especially, as pain, heat, and discoloration of the structures in which the matter is formed, or any constitutional disorder; the whole process being apparently conducted as if both the part and system were unconscious of what is going on. Such cases are by no means infrequent, and yet if they be carefully investigated, or traced through the various stages of their progress

up to the dissection of the affected tissues, the most satisfactory proof will be afforded of their phlogistic nature. In a cold, strumous or scrofulous abscess, for example, which has so often served as the basis for this, now nearly exploded idea, and the formation of which is sometimes the work of several months, inflammation is just as much concerned in the production of its contents, as in a phlegmonous boil that is developed in three or four days. The only difference is, that in the one the morbid process moves on slowly and almost imperceptibly, while in the other it proceeds very rapidly, and is accompanied by such well-marked symptoms as to render it impossible to mistake their character.

Pus may be formed, as is well known, without any breach of continuity of the affected parts. This mode of suppuration is, in fact, very common, not only in the serous cavities, but throughout nearly the whole of the mucous system. It is not, however, confined to these textures. In the cellular substance, lungs, brain, liver, and other viscera, nothing is more frequent than suppuration, without any ulceration whatever in the inceptive stages of the morbid action.

The formation of purulent matter does not take place with equal facility in all the organs and textures. Of the viscera, those which are most prone to take on suppurative action are the liver, lungs, and brain; of the tissues, the cellular, cutaneous, mucous, and serous. In the fibrous, cartilaginous, tendinous, and osseous textures, this fluid forms with difficulty, and is seldom of a thick, consistent nature. Of the mucous system some portions are more liable to be affected with suppuration than others. Thus, it is much more common to find pus in the colon than in the stomach or ileum, in the vagina than in the uterus, in the urethra than in the urinary bladder, in the nose than in the mouth, in the fauces than in the œsophagus, in the bronchia than in the larynx. So, likewise, in the serous system, suppuration is more frequent in some situations than in others; as, for example, in the pleura, the vaginal tunic of the testicle, and the lining membrane of the larger joints. In the subcutaneous cellular texture, pus is most readily formed in those parts which are remote from the central organ of the circulation. The bloodvessels do not often suppurate, except when wounded; and the same, so far as we know, is the case with the absorbents. The lymphatic ganglions, however, are very frequently affected in this way, especially those of the axilla, the groin, the mesentery, and the base of the lower-jaw, particularly in persons who are predisposed to scrofulous disease. The nervous tissue seldom suppurates, and the muscular still more rarely. From all these facts we may deduce the axiom, that those structures are most prone to form matter which contain the largest amount of loose cellular substance, and, conversely, that those which possess this tissue sparingly always suppurate with difficulty, requiring in general a much longer period, and elaborating a less perfect fluid.

The period at which suppuration may occur after the establishment of inflammation varies, on an average, from twenty-four hours to three or four days, depending upon the nature and situation of the affected tissues, the intensity of the morbid action, and also, and that in a mate-

rial manner, upon the condition of the system, and the character of the exciting cause. Mucous membranes, especially if exposed to the air, generally suppurate very readily, having, as it were, a predisposition to take on this kind of action; serous membranes, on the contrary, suppurate with difficulty, one reason of which is that, being arranged in the form of shut sacs, they do not feel the stimulus of the atmosphere; another, doubtless, is the fact that such structures, when irritated, are naturally inclined to furnish lymph rather than pus, their organization peculiarly fitting them for that office. The same difference exists between the veins and arteries, and it is practically fortunate that it does; otherwise the danger of wounds, whether the result of accident or design, requiring the ligation of the principal arteries, would be much greater than experience has shown it to be. No surgeon likes to tie a large vein, well knowing that the operation may be followed by fatal suppuration of its lining membrane. In some of the internal viscera, as the brain and liver, pus sometimes forms with great rapidity, as is seen in cases of injuries of these organs. Matter, other things being equal, forms more rapidly when the inflammation is very intense than when it is comparatively mild. A wound inflicted upon an unhealthy or intemperate person will be more likely to run speedily into suppuration than one of a similar character occurring in an individual of sound constitution and regular habits. A phlegmonous boil will usually begin to deposit pus in from twenty-four to thirty-six hours, whereas a chancre does not furnish any, so far as we are able to judge, until the beginning of the fourth day. In variola, the suppurative process is generally not fully established until about the ninth day.

Exposure of an inflamed surface to the air greatly promotes suppurative action, and is, consequently, directly hostile to adhesion. The more nicely the edges of a wound are approximated, the greater, all other things being equal, will be the probability of speedy and permanent reunion, and conversely. Serous membranes, as already stated, have naturally a disposition, when inflamed, to pour out lymph, and become glued together; but whenever they lose the character of closed sacs, as they necessarily do when they are accidentally opened, the morbid action, consequent upon the injury, is certain to be followed by the formation of pus, especially if the air is permitted to have free access to them for any length of time.

Pus, when first effused, generally appears in the form of distinct globules, which are dispersed through the affected structures, and can be easily recognized by their pale yellowish color. As the purulent particles increase in number, they gradually become confluent by the removal of the parts concerned, and in this way the matter is at length collected into an abscess.

The symptoms which characterize the suppurative process will claim special attention when we come to speak of abscesses. Meanwhile, it will suffice to observe, in general terms, that they are such as denote the existence of ordinary inflammation, with an increase, more or less considerable, of the local and constitutional disturbance.

Pus, the product of suppuration, has been an object of anxious study from the earliest ages of the profession down to the present time;

but it has only been within a comparatively recent period that any real and reliable light has been thrown upon its physical, chemical, and microscopical properties.

When genuine, or, as it is not unaptly termed, good, healthy, or laudable, pus is of a white, yellowish tint, opaque, homogeneous, of a sweetish taste, without any particular smell, and of the consistence of thin cream. It is heavier than water, in which it is partly dissolved, emits a faint, mawkish odor on being heated to the natural temperature of the body, resists putrefaction with remarkable pertinacity, and is coagulated by heat, alcohol, and hydrochlorate of ammonia. Pus freezes less rapidly than water, and when thawed does not regain its original properties.

The specific gravity of pus is liable to considerable variation. It is less than that of blood, and greater than that of serum. According to Gueterbock, it ranges from 1030 to 1033. In seven distinct examinations of pus, taken from abscesses in different situations—as the thigh, arm, axilla, back, pleura, and the lung in pulmonary phthisis—Dr. John Davy found the specific gravity as low in one as 1021, and in another as high as 1042. This great disparity is mainly attributable to two circumstances, the unusual quantity of the solid ingredients, and the variable density of the liquid part.

The *chemical* constitution of pus has been examined by a great number of experimentalists. The results of their investigations tend to show that pus contains most of the elements of the blood. The following analysis is by Gueterbock, from the pus of an abscess in the human breast.

Water	86.1
Fat, soluble only in boiling alcohol	1.6
Fat and osmazome, soluble in cold alcohol	4.3
Albumen, pyine, pus globules and granules, soluble neither in hot nor in cold alcohol	7.4
Loss	0.6
	100.0

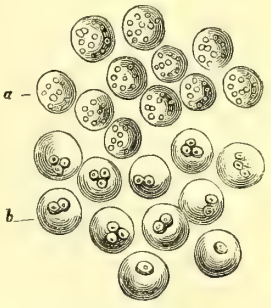
Lehmann has investigated the chemical composition of the different elements of pus with great care. Normal pus he found to contain from 14 to 16% of solid constituents, of which from 5–6% belonged to mineral or inorganic substances. The most usual insoluble salts of pus are the phosphates of lime and magnesia, and the sulphate of lime; the principal part of the soluble salts is furnished by chloride of sodium. The quantity of fat was found to vary from 2–6%; the quantity of albumen in the serum from 1.2 to 3.7%. Casein and the coloring matter of the blood do not occur in normal pus. A substance which usually enters into the composition of pus is *pyine*. Gueterbock, who discovered it, considers it as a peculiar animal principle. Its exact nature is not understood. It is supposed by some to be an oxide of protein, by others a form of fibrin. It can be precipitated from pus by acetic acid, or by alum. It is soluble in water, but insoluble in alcohol.

With regard to the composition of the compound part of the pus globules we possess no positive knowledge. The cell walls, contents,

and nuclei, react like protein bodies, and are probably of an albuminous nature. The cell walls are dissolved by acids, but resist the action of alkalies.

Pus, *microscopically* examined, is found to be composed of numerous small corpuscles suspended in a thin, transparent fluid, called the pus-liquor. These little bodies, which have received the name of pus globules, are generally of a spherical form, and vary in size from the $\frac{1}{2000}$th to the $\frac{1}{300}$th of an inch in diameter. They are mostly very granular, and possess a delicate cell wall, which becomes distinct on the addition of water. They are nucleated; some containing one well-defined nucleus; others two, three, or more small nuclear bodies. Acetic acid has the effect of rendering them apparent; the cell-contents and wall becoming transparent under its influence, especially if the acid be undiluted. Fig. 14 exhibits pus corpuscles in their natural state as well as their appearance when acted upon by acetic acid.

Fig. 14.



a. Natural appearance of pus corpuscles. *b*. Appearance after the application of acetic acid. (LEHMANN.)

These corpuscles float in the purulent liquor, but they are not the only solid elements observable. Pus exhibits, besides these, granules, shreds of fibrin, and exudation corpuscles of varying shape; also, at times, small homogeneous, non-nucleated corpuscles, termed pyoid.

Pus is liable to be modified in its properties by the presence of extraneous substances, such as grumous blood, fibrin, cholesterine, and the debris of the organs and textures in which it is formed. In common phlegmon, it often contains shreds of cellular tissue, of a dirty grayish color, not unlike wet tow. The brownish matter found in certain abscesses of the liver probably derives its color and consistence from the intermixture of the softened and broken-down hepatic parenchyma. In suppuration of the different glands, the pus is not unfrequently mingled with the product of their secretion. Thus, in the kidney, it may blend itself with the urine, in the liver with the bile, in the mamma with the milk, in the testicle with the semen. Purulent matter is sometimes very fetid, probably from the extrication of sulphuretted hydrogen.

The different varieties of pus have received different names. When the fluid is of a whitish color, creamy in its consistence, and composed of a great number of globules, it is said to be *healthy*, pure, or laudable, in reference to the process by which it is produced, which is of a healthy, sanative, or restorative nature. It is usually met with in suppurating wounds, in healing ulcers, and in phlegmonous abscesses. Its properties have been already sufficiently described.

Sanious, serous, ichorous, or sanguinolent pus is thin, almost transparent, of a yellowish, oily, or reddish color, and generally so acrid as to erode the parts with which it comes in contact. It is a product

of unhealthy inflammation, and is principally observed in caries of the bones, in irritable ulcers, and in open cancer. This variety of pus is frequently blended with grumous blood, flakes of fibrin, and the debris of the affected tissues.

Fibrinous pus consists of common pus in combination with lymph. It is of a whitish, grayish, or cineritious color, and of a semi-liquid, concrete, or lardaceous consistence. Under the microscope, it displays the globules of healthy pus, with numerous other cells and fibres of irregular shape. It is commonly found in the joints, the splanchnic cavities, in metastatic abscesses, and in carbuncular inflammation. Its presence denotes a high degree of morbid action.

Scrofulous pus is mostly seen in pulmonary caverns, cold abscesses, scrofulous disease of the joints, and chronic inflammation of the lymphatic ganglions. It usually separates into two parts, of which one is thick, straw-colored, and inodorous; the other thin, ropy, and mixed with small, opaque, curdy flakes. When scrofulous pus is long retained it may acquire a disagreeable, nauseous smell, not unlike the pollen of the chestnut; at other times it is excessively fetid. The attendant action is usually very languid.

There is a variety of pus to which, from its admixture with mucus, the term *muco-purulent* is applied. It is usually a product of a high degree of inflammation of the various outlets of the body, particularly the nose, eye, bronchial tubes, and genito-urinary apparatus. The mucus which proceeds from these surfaces in the healthy state is composed of a transparent fluid, and of abraded epithelial cells, flat, and irregularly sided, with a central nucleus. In addition to these, the microscope detects numerous granular masses and spherical globules, similar to those of pus; the whole being suspended in a viscid, transparent, ductile fluid. Under inflammation, the epithelial cells are cast off so quickly that they have not time to become flattened out, and the globules are not only greatly augmented in number, but they acquire somewhat the character of those of pus.

Finally, there is what is called *puriform* matter, a substance which, as the name implies, is not true pus, but an imperfect liquid bearing some resemblance to it. It is found chiefly in bad forms of inflammation, as erysipelas, carbuncle, and pyemia, and consists essentially of broken-up lymph and shreds of tissue, interspersed with fatty substance, granules, abortive cells, and a few globules, smaller than those of pus, and not affording the usual reaction under acetic acid.

Certain kinds of pus, as those, for example, of smallpox, varioloid, gonorrhœa, and chancre, are *contagious*. In what particular element of the fluid the virus or specific secretion is contained, or whether it exists as an entity, is undetermined. The vitality of the organ by which it is elaborated is not necessary for the preservation of its peculiar effects. Once secreted, it becomes independent of its source, and retains, for a considerable period, the power of contaminating the parts to which it is applied, producing a disease of the same character. Various chemical agents, however, as the alkalies and acids, have the property of neutralizing or destroying it, so that, if inocula-

tion be afterwards attempted, no effects will follow. If the pus of a chancre be examined with the microscope, it will often be found to contain animalcules, particularly the vibrio lineola.

Lastly, the question may be asked, how is pus produced, or whence it is derived, and how it is formed? Boerhaave and some of his followers attributed it to a dissolution of the solids; Pringle and Gaber, to decomposition of the serum; Gorter and Quesnay, to changes induced in the coagulating lymph. In 1722, Dr. Simpson, of Scotland, threw out the hint that pus is a peculiar morbid secretion, always preceded and accompanied by inflammation, and bearing a close resemblance to the secernent action which presides over the elaboration of bile, saliva, and other fluids. He insisted that the process was a vital, and not a mere chemical one, as had been asserted by his predecessors, and as was generally believed even in his own day. A similar opinion was afterwards advanced by Dr. Morgan, of this city, in his inaugural dissertation, published at Edinburgh in 1762. In consequence of the views thus expressed, the theory of Simpson soon became the prominent doctrine of the schools in all parts of the civilized world; and it is not a little remarkable that it maintained itself in the unshaken confidence of the profession until within a comparatively recent period. Pathologists had long been aware that pus contained all the elements of the blood, excepting the coloring matter; but no one had attempted to explain the manner in which it is deprived of this substance, until the series of interesting experiments performed by Gendrin. On inspecting the capillaries of a frog's foot, which had been for some time in a state of inflammation, this distinguished observer noticed, as he thought, the changes which the globules of the blood undergo preparatory to their conversion into pus. At first the vessels were dilated from excessive sanguineous engorgement; but in the course of a day or two, the circulation became remarkably tardy, and they were then seen to be distended with a pale grayish fluid, inclining somewhat to yellow. In its character this fluid was essentially globular, the particles of which it consisted being considerably larger than those of healthy blood, and differing in their aspect according to the degree of the metamorphosis they had experienced. Thus, at the centre of the inflamed part, they were of the color of cream, a little further on, of a grayish appearance, while towards the periphery, where the alteration was still very imperfect, they were partly red, and partly yellow, with various intermediate shades, more easily discerned than described.

Observations made since those of Gendrin, principally by J. Hughes Bennett, Wharton Jones, Paget, C. J. B. Williams, Gerber, Gulliver, and Lebert, tend to show that what the French philosopher supposed to be pus corpuscles were nothing but colorless blood globules, which naturally exist in this fluid, and the number of which is always greatly augmented in inflammation; generally in proportion to the intensity of its action. They have, moreover, shown that pus, instead of being a product of secretion, as was formerly imagined, is nothing but altered coagulating lymph, fibrin or plasma, so abundantly effused at the focus of the morbid action, and converted into pus corpuscles.

The latter resemble, in their size, shape, and structure, the corpuscles in the effused lymph, one of the principal differences consisting in the presence in the former of more or less oil. If this view be accepted, it follows, as a necessary corollary, that purulent matter is formed exterior to the vessels, by a species of disintegration and decay of the plastic elements of the blood, thrown off as an effect of inflammation.

Pus globules, as has been already seen, are nucleated cells which have their origin in germs that pre-exist in the effused lymph, but which are not fully developed until they have been subjected to a species of metamorphosis, the precise nature of which has not yet been explained. The change is probably partly of a vital, partly of a chemical nature; or, possibly, it may be mainly of the latter description, the peculiar color, form and size of the pus globules being dependent upon transformation effected in the exudation. Rokitansky has advanced the idea that the pus corpuscles may change, by a kind of exogenous process, if not also by an endogenous one, into granule cells; a view which seems to me neither plausible nor consistent with the established doctrine of ordinary cell formation. No development of this kind can occur without the agency of the vital principle, and it is hardly possible to conceive that a pus globule should be so endowed after it has attained its full growth. Rokitansky also supposes that the fluid in which the corpuscles are suspended may give rise to a large amount of oily matter.

The more aplastic or degraded lymph is, at the moment of its deposition, the more likely will it be to be transformed into pus; hence what has been called corpuscular or croupous lymph is much more prone to assume this character than the fibrinous, or more organizable variety of this product. The degeneration is also, no doubt, materially influenced by the softened and disintegrated condition of the affected tissues, in the meshes of which the lymph is situated, such a change being highly favorable to the development of pus germs, or, what is the same thing, inimical to the production of healthy blastema.

Pus is susceptible of absorption, probably in all its varieties, as well as in almost every locality. Satisfactory proof of this fact is afforded by what occurs in abscesses in the different external parts of the body; and it is therefore analogically reasonable to infer that it may also take place in the internal organs and cavities. Great doubt has recently been expressed, especially by some of the French pathologists, respecting the possibility of pus being taken up in this manner, on the ground, chiefly, that the accumulations which occasionally disappear, both spontaneously and under treatment, are really not abscesses, but collections of plastic matter. Every surgeon, however, of experience, knows that pus, or puriform fluid, has again and again been removed by the agency of the absorbents, after its existence had been satisfactorily tested by the exploring needle. Particular remedies are often employed for the attainment of this object, and our efforts, I am sure, are not unfrequently crowned with success, although probably not as often as is generally supposed.

It is extremely probable that the thinner parts of pus are carried

into the system, without any previous change; whereas, the pus globules are no doubt obliged to undergo a species of degeneration and disintegration, before they can be acted upon by the absorbent vessels. Whether the fatty matter remains, or whether it, also, is removed, has not been determined. How pus is disposed of, after it has reached the circulation, is likewise unknown; but the most reasonable conclusion is that it undergoes oxidation, and is excreted by the liver and kidneys, if not, also, by some of the other emunctories.

ABSCESSES.

An abscess is a circumscribed cavity of abnormal formation, containing pus. When the matter is poured out into a natural cavity, as the chest, or within a joint, the collection constitutes what is called a purulent effusion. An abscess may be superficial or deep, acute or chronic, common or specific. An abscess is said to be superficial when it is immediately beneath the common integuments or in the cellular substance among the superficial muscles. The word deep, on the contrary, is used when the matter is lodged in an internal organ, in the substance of a bone, or among muscles, bound down by a large quantity of tissue. The terms acute and chronic have reference merely to the time occupied in the formation of the abscess. A common abscess is one produced by ordinary inflammation; while the specific abscess is the result of the operation of some particular poison, as the virus of chancre, smallpox, or glanders. Finally, an abscess is circumscribed, as when it is bounded by plastic matter; or diffuse, as when its contents are sent abroad through the connecting areolar tissue.

The most philosophical division of abscesses is into phlegmonous, scrofulous, and metastatic, the first being incident to all persons, while the second is capable of occurring only in certain classes of individuals, or such as are affected with a strumous taint of the system. The term "metastatic," formerly so much in vogue, is employed to designate those collections of pus which are consequent upon severe injuries, operations and diseases, and might be advantageously abolished, as it is only calculated to convey false impressions respecting a form of suppuration, which properly comes within the definition of phlegmonous, although, as will be shown by and by, it is generally supposed to have its origin in a toxical condition of the blood. It has recently been described under the term "multiple," and will claim particular attention under the head of pyemia. It is not easy, in the present state of the science, to assign an appropriate place to the diffuse abscess, as it is often impossible to determine its real character. The specific abscess will not require any special consideration, since, apart from its exciting cause, its mode of formation does not, so far as we are able to comprehend it, differ at all from that of the common phlegmonous abscess.

1. PHLEGMONOUS ABSCESS.

A phlegmonous abscess is one which runs its course with unusual rapidity, and which is always accompanied by well-marked inflammatory

symptoms. The part feels, as the name implies, as if it were on fire, being hot, tender, and exquisitely painful. A tensive, throbbing sensation is generally present; it is synchronous with the contraction of the left ventricle of the heart, and is always greatly aggravated by dependent position; it is particularly severe at the focus of the morbid action, and is a valuable diagnostic symptom, as it is generally denotive of suppuration. Its immediate cause, as explained elsewhere, is obstructed circulation, and consequent pressure upon the nerves of the affected structures.

If we examine the *anatomy* of a phlegmonous abscess, we shall find it to be a very curious structure, growing out of several highly interesting pathological changes. In the first place, the matter is obliged to have a receptacle for its accommodation. This is usually furnished by the cells of the connecting areolar tissue of the part; but as the accumulation, which is at first drop-like, progresses, this substance is destroyed by ulcerative action, and in this way a cavity is gradually formed, often capable, in the end, of holding an immense quantity of fluid. While the process of deposition is going on, plastic matter is poured out at the periphery of the cavity, gluing up the cellular tissue, and forming thus a kind of boundary line around the pus, by which its diffusion among the surrounding structures is effectually guarded against. No distinct cyst is built up, for nature has not time for such an enterprise, nor is she at all in need of it, although the occurrence is not impossible even in acute abscess, especially in one of the liver. The next circumstance to be observed is the effort which the matter makes to reach the nearest surface, for this is one of the laws of interstitial suppuration. To this object the matter itself is eminently contributary, the pressure which it exerts upon the superimposed parts greatly promoting and expediting the ulcerative action, by whose agency evacuation is finally attained. Thus, at least three separate and distinct processes are going on during the formation of an abscess; a deposit of pus, an effusion of lymph, and ulceration. The importance of an effusion of plastic matter is shown by the fact that, when it fails to be furnished, the contents of the abscess are widely diffused among the surrounding structures, committing extensive havoc in the connective tissues, and causing frightful separation of the muscles. These evil effects are often witnessed in phlegmonous erysipelas, where, in consequence of the cacoplastic character of the lymph, the matter occasionally burrows to a great distance, destroying everything within its reach.

The great law which presides over the evacuation of abscesses, by which their contents are enabled to reach the nearest surface, is attended with the most fortunate results, for it not only abridges suffering, but also saves structure. Thus, in abscess of the liver, a long time would elapse, and an immense amount of pain and constitutional disorder would be caused, if the matter, instead of emptying itself, as it usually does, into an adjoining coil of intestine, were compelled to travel across the walls of the abdomen.

The *contents* of the phlegmonous abscess usually partake strongly of the nature of well-elaborated pus, being of a whitish, or pale straw

color, and of a thick, cream-like consistence, with an abundance of large and well matured pus corpuscles. Intermixed with them are often flakes of lymph, and the debris of the affected structures. Thus, in abscess of the external parts of the body, it is not uncommon to meet with shreds of areolar tissue; in abscess of the liver, with broken-down hepatic substance. Occasionally, again, the pus is blended with the peculiar secretion of the part, as semen in abscess of the testicle, bile in abscess of the liver, milk in abscess of the mamma. A knowledge of these facts is of great practical value, as a means of diagnosis, the nature of the adventitious matter often pointing directly to the seat of the disease. Some forms of acute abscess, as those more particularly which follow severe accidents and capital operations, and to which the term metastatic is sometimes applied, are made up almost entirely of fibrinous matter, the quantity of pus corpuscles being extremely small. The contents of certain abscesses are excessively fetid. This is especially true of abscesses around the anus from the proximity of the pus to the bowel, or from the actual intermixture of fecal matter. The same circumstance occasionally obtains, although generally in a less degree, in abscesses in some other situations, as of the tonsils, bones, and lymphatic ganglions.

Abscesses sometimes contain air, the fluid resting upon the top of the matter. Such an occurrence is most liable to happen in the perineum, about the sacrum, in the ileo-lumbar region, and in front of the abdomen, in consequence of the existence of a communication with the intestinal tube. A similar phenomenon is occasionally witnessed in suppuration of the chest, when the matter, contained in that cavity, makes an effort to escape externally through one of the intercostal spaces, after an opening has been made into a bronchial tube. In general, the pus, when thus admixed, is excessively fetid, and the abscess is distinctly emphysematous, crepitating under pressure, and often emitting a peculiar gurgling noise.

Phlegmonous abscesses are liable to occur at all periods of life, and in all classes of individuals. We occasionally meet with them within a few weeks after birth, especially in the mamma and in the lymphatic ganglions about the neck, and in the axilla. They may be traumatic, or idiopathic; or, in other words, dependent upon external injury, or constitutional causes, as derangement of the digestive organs, or the suppression of some important secretion, as that of the liver, kidney, or uterus. Abscesses are sometimes of a secondary character, one forming after another, as if there existed a species of pyogenic diathesis. Such an occurrence often proves exceedingly untoward, sadly interfering with recovery, especially when it manifests itself during the progress of convalescence after protracted fevers and severe injuries.

Abscesses of this kind may form in any part of the body; but they are most commonly observed in the areolar tissue, beneath the skin, among the muscles, and around the lymphatic ganglions, as well as in the substance of these bodies, especially in those of the neck, axilla, and groin. Among the internal organs, those that are most liable to

suffer are the liver, lungs, and brain, but even here phlegmonous abscesses, except as a result of external injury, are extremely rare.

The number of abscesses varies from one to a great many; being generally in an inverse ratio to their size. Two or three large ones occasionally exist simultaneously in different parts of the body, and, on the other hand, the whole surface is sometimes, as in variola, literally covered with small ones. The size of a phlegmonous abscess ranges from that of a mustard seed up to that of an adult's head.

The *symptoms* which precede and accompany the formation of a phlegmonous abscess are subject to much variety. In general, they are such as characterize ordinary inflammation. The part, when open to inspection, is found to be red, hot, swollen, and painful, beating and throbbing synchronously with the contraction of the left ventricle of the heart. As the matter accumulates, all these symptoms augment in severity, especially if the fluid be bound down by hard, unyielding structures, interfering with its extension. Under opposite circumstances, however, the pain often diminishes, the part feeling relieved almost as soon as the deposition of pus has fairly begun. However this may be, the discoloration of the skin always increases as the matter approaches the surface, and generally assumes a dusky, purple, or livid aspect, particularly at the focus of the abscess. The swelling also augments, and the part often pits on pressure, more or less serum being effused into the subcutaneous cellular substance. The heat is much greater than it is in the surrounding structures, and there is always serious functional disorder.

The morbid action continuing, the centre of the abscess becomes acuminated, and the matter, in surgical language, is said to point. The skin here is not only greatly discolored, but thin and impoverished; and giving way at the most prominent part of the tumor, allows its contents to escape, generally by a small orifice, which is often entirely inadequate to thorough clearance. The period which intervenes between the commencement of the inflammation that leads to the formation of the abscess, and the evacuation of the pus, varies from a few days to several weeks.

When an abscess of this kind is small, or situated in a comparatively unimportant part, the constitution may fail to take any cognizance of it whatever. But this is rather the exception than the rule; for, in the majority of cases, the system warmly sympathizes with the local trouble, and manifests the interest it feels in it by well-marked inflammatory symptoms. If an abscess is about to form in an internal organ, the patient will be seized with rigors, often violent and long continued, alternating with flushes of heat, and generally followed by copious sweats. This frequently happens even when the abscess is of very trivial size; the importance of the affected structures giving proportionate force to the morbid action. Rigors also generally occur in abscess of the bones and joints, but comparatively seldom when the disease is seated in the subcutaneous cellular substance. Abscess of the ear, parotid gland, tonsils, anus, and perineum are nearly always attended with high constitutional excitement. If the case is at all severe, delirium will be apt to be present, lasting either until the part

is relieved, or until the disease proves fatal. The countenance is generally flushed, the eyes are suffused, and there is frequently a hectic spot upon the cheek, especially in internal suppuration. The pulse is full, strong, and frequent; the skin hot and dry; the urine scanty, high colored, and loaded with uric acid. Great thirst and restlessness usually exist. When the abscess is fully formed, the constitutional symptoms, as well, indeed, as the local, often greatly abate, comparative comfort succeeding the violent perturbation. The pulse becomes soft and calm, the surface is bathed with perspiration, the renal secretion increases in quantity and improves in quality, and the patient falls into a tranquil sleep, grateful for the happy change.

Diagnosis.—Notwithstanding that the symptoms of phlegmonous abscess are usually well marked, cases now and then arise where the diagnosis is so obscure as to cause serious doubt respecting their true character. Indeed, there is probably no department of surgery where so many mistakes are constantly committed as in this. If the records of the science could be thoroughly explored, they would, I am sure, be found to abound in blunders of diagnosis in this kind of abscess. As it is, we frequently hear of encephaloid tumors, aneurism, and hernia being opened for abscesses, and life either destroyed upon the instant, or placed in great ultimate jeopardy, by the operation. Such mistakes are hardly less injurious to the surgeon than to the poor patient; for they but too certainly ruin his prospects and reputation as a practitioner. Attention to the following circumstances, will, I trust, enable the reader to steer clear of difficulty: 1. The history of the case; 2. Pointing; 3. Fluctuation; 4. Œdema; 5. The use of the exploring needle.

1. The first object that claims attention is the *history* of the case. Upon inquiry, it will usually be found that the disease has been of short standing; having commenced with the ordinary symptoms of inflammation, and gradually increased until the suppurative point was attained, the fever being high, and the local distress often extreme. Rigors are looked for if the abscess be deep seated, extensive, or among important structures; the pain is tensive and throbbing, steady and persistent, not intermittent, or severe at one time, and absent at another. If the abscess be lodged externally, the swelling is observed to be gravescent, unnaturally hot, excessively tender, intolerant of manipulation, and of a dusky reddish color, especially at its most prominent point. Its career is comparatively brief, a few days, a week, or, at most, a fortnight, sufficing to reach its acme. Then comes the period of dissidence, if the matter is not evacuated; the symptoms abating in severity, the pulse and skin becoming soft, and the pain losing its throbbing character.

2. *Pointing* is a symptom of great importance in the diagnosis of phlegmonous abscess. It is always most conspicuous where there are, or were, most pain and discoloration. The skin looks dusky or livid, and feels thin and attenuated as if it were ready to give way, which, in fact, it generally is. A tumor, benign or malignant, may also point, but a careful consideration of the history of the case will commonly suffice to show the difference.

3. An abscess, near the surface, always *fluctuates*, that is, its contents permit themselves to be displaced on one side, and to be rendered correspondingly prominent upon the opposite. Two methods may be adopted in conducting the examination. In one, alternate pressure is made with the hands or fingers resting upon opposite sides of the abscess. As one hand or finger sinks in the other is elevated, and whenever this is the case there can be no question about the existence of fluid, although the fluid may not be purulent. The other method consists in percussing the tumor with one hand, the other hand being placed upon the opposite side. If matter be present, an undulatory motion will be imparted, one of the surest signs of the occurrence of suppuration. This method, however, is less delicate than the other, and is applicable only to abscesses of unusual volume. Finally, when the matter is seated superficially, its presence may often be detected by passing the finger over the most prominent part of the swelling, when, if there be pus, it will generally sink in a little, in consequence of the skin at that part being less resistant than at the periphery of the tumor. This method of examination is particularly valuable in small superficial abscesses of the scalp, perineum, tibia, clavicle, fingers, and other superficial portions of the skeleton.

4. Valuable information is often obtained from the appearance of the *swelling*. Thus, when the matter is very deep seated, as in abscess of the thigh, the existence of œdema is nearly always decisive of the nature of the case, especially when it is conjoined with a hard, brawny state of the parts. The fluid cannot reach the surface on account of the manner in which it is bound down, but its presence causes inflammation in the skin and subjacent cellular substance, leading to an effusion of serum, and consequently to more or less pitting under the pressure of the finger. In empyema, or purulent collections in the pleura, œdema of the chest, directly over the seat of the fluid, is usually a prominent, and, indeed, in many instances, a characteristic symptom. A puffy and œdematous state of the scalp is often denotive of abscess of the brain and dura mater, in cases of injury of the skull.

5. The *affections* which are most liable to be mistaken for abscess are encephaloid, aneurism, and hernia. From the first of these the history alone of the case will generally suffice for a correct diagnosis. Encephaloid is a chronic affection; a phlegmonous abscess, an acute one; the first is attended with little or no pain until ulceration sets in; the latter is attended with a great deal, generally from the moment it begins until it is evacuated. An abscess may be mistaken for an aneurism, especially if it be seated over a tolerably large artery, which communicates to it its impulse. I recollect a notable case of this kind which occurred, many years ago, in the Louisville Hospital, and which created quite a sensation at the time. The patient, a young English sailor, had a globular tumor, the volume of a fœtal head, in the epigastric region. It had existed there, in a marked degree, for upwards of a month, and as it received a distinct impulse from the aorta, it was believed by the surgeons in attendance to be an aneurism of that vessel. The patient was apprised of the supposed nature of his disease, and his only regret was that he should never be able to reach

his native country. The man soon after this fell into the hands of Dr. Donne and myself, when, upon introducing an exploring needle, we found that the tumor was not an aneurism, but an abscess seated deeply in the wall of the abdomen.

A strangulated hernia of the groin, abdomen, or upper part of the thigh might be mistaken for an abscess, but such an accident could hardly happen in the hands of an experienced surgeon. The history of the case, the peculiar character of the swelling, and the existence of symptoms of strangulation will always be sufficient to clear up any doubt that may arise respecting the nature of the case.

6. When, notwithstanding the most thorough scrutiny of the case, its nature remains undetermined, recourse must be had to the exploring needle, which often decides the question in a moment. The instrument which I usually prefer is an ordinary cataract needle, introduced at the most prominent part of the swelling down to its very centre, and freely rotated upon its axis, in order to condense, as it were, the walls of the puncture, and thereby facilitate the flow of fluid. If the contents be purulent, the circumstance will be revealed by the appearance of a drop of pus at the orifice; whereas if the swelling be an aneurism the discharge will be sanguineous. If the tumor be encephaloid, probably nothing will appear, except a little blood consequent upon the penetration of the instrument.

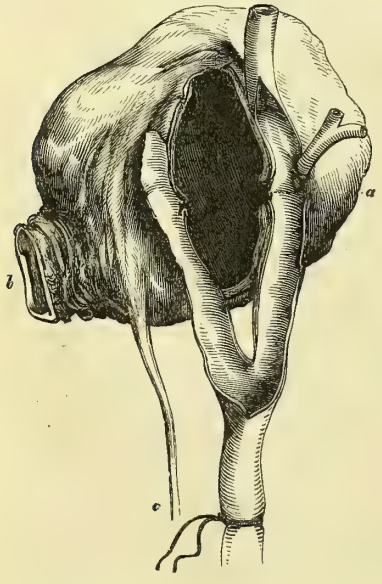
Prognosis.—The prognosis of this disease is influenced by a variety of circumstances, of which the most important are the size, number, and seat of the abscesses, and the age, habits, and constitution of the patient.

A large accumulation of pus is, other things being equal, more dangerous than a small one, because it not only produces more havoc among the tissues, but it exerts more severe pressure upon the surrounding parts, and establishes a greater drain upon the system. Number has an important bearing upon the prognosis. A man may struggle through several abscesses, even when of considerable bulk, but when he is laboring under a great many he must be extremely fortunate, indeed, if he do not sink under them. Smallpox is always a dangerous disease, chiefly on account of the enormous number of abscesses which attend its progress; few patients being capable of withstanding the irritation and consequent prostration occasioned by their development. The situation of the matter is an object of importance. Thus a small abscess of the perineum may cause fatal retention of urine, as a small abscess of the fauces may induce death by compression of the glottis. Importance of structure is another circumstance which influences the issue of the case. An abscess of an internal organ, as the liver, is more dangerous, and more likely to prove fatal, than an abscess of an external part of the body, as a lymphatic ganglion.

The recovery of a person laboring under phlegmonous abscess is often materially influenced by his age, habits, and state of constitution. Young adults and middle-aged subjects usually get on better than children and very old persons, who often meet such attacks very poorly, making a very feeble show at resistance. The intemperate man has a worse chance than one of good habits, and the man of bad previous health than one who has always had an excellent constitution.

Treatment.—The treatment of phlegmonous abscess is conducted upon general antiphlogistic principles; by depletion, purgatives, antimonials, and the ordinary topical means, to limit deposit and save structure, and afterwards by the lancet to favor evacuation and reparation. Sometimes spontaneous removal is looked for, as when the abscess is seated just beneath the periosteum, as an effect of tertiary syphilis, or when it occupies a lymphatic ganglion, and has yet made little progress; favored, if necessary, by the administration of mercury and iodide of potassium, and the application of iodine, blisters, and other sorbefacients. But such cases are exceptional, and do not affect the general rule of practice, which always seeks an early outlet for the pent-up fluid. In some situations we do not even wait for well marked pointing, much less distinct fluctuation; but, assured that matter is present, make an early and free incision, thus abridging suffering and saving structure. The beneficial effects of this practice are strikingly illustrated in abscesses in various parts of the body. Thus, in purulent collections around the anus, an early outlet is indispensable to prevent the matter from burrowing along the side of the rectum and perforating its walls, thereby forming an anal fistule. Abscess of the perineum requires prompt interference to prevent retention of urine and the establishment of urethral fistule; of the fingers, to prevent the matter from travelling along the sheaths of the tendons and so producing extensive sloughing and necrosis; of the fauces and tonsils, to prevent suffocation by the pressure of the swelling upon the glottis. The torturing pain of a gum-boil, an abscess of a tooth, bone, and periosteum, is often instantly relieved by an early and free incision. The same procedure in deep-seated abscess of the extremities, not only relieves pain and constitutional irritation, but prevents the pus from burrowing among the muscles, and thus causing extensive destruction of the connecting cellular tissue.

Fig. 15.



Mr. Liston's case. *b.* The external opening of what was an abscess. *a.* The ulcerated communication between the cyst and the carotid artery; the latter has been sliced open. *c.* The par vagum.

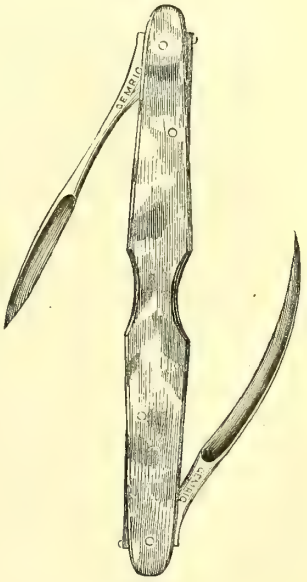
An abscess should be opened early when, from its proximity to a large vessel, there is danger that, if neglected, a communication will be established between them, thus leading to fatal hemorrhage. Such an event will be particularly liable to occur in delicate children laboring under the effects of scarlatina, measles or smallpox, and in elderly subjects worn out by long suffering and an impoverished state of the blood. The arteries most subject to this danger are those about the neck.

In Mr. Liston's celebrated case, the abscess opened into the external carotid; it was punctured, and the patient perished from hemorrhage. The parts are represented in the annexed cut (fig. 15).

Artificial evacuation may be effected by the knife or caustic. The latter, at one time so much in vogue, is now seldom employed by any one, and it would be difficult to conceive what possible advantage it can possess over the former, which is incomparably more expeditious, less painful, and more certain. I would not so far humor a patient as to use caustic when my judgment plainly condemned it, simply because he was foolishly timid, especially now that we can so readily prevent all apprehension and suffering by the administration of anæsthetics; nor would I, on the other hand, resort to caustic with the view of promoting suppurative action, since we have always at our command articles infinitely more desirable and efficacious. If, however, such a remedy should be called for, the best one is the Vienna paste, applied as in making an ordinary issue, the eschar being afterwards penetrated, if need be, by the bistoury, now no longer dreaded by the patient.

Various instruments are employed for opening abscesses. The awkward, clumsy thumb lancet, which formerly found a conspicuous place in every pocket case, is now but seldom used, having been advantageously superseded by the scalpel and bistoury. The scalpel is, however, rarely employed, except in very large abscesses, where it is necessary to make a very free division of the overlying structures. By far the neatest contrivance for the purpose is the little bistoury, represented in the accompanying sketch (fig. 16), which I have used, almost exclusively, for many years. It consists of two very narrow, sharp-pointed blades, one straight, and the other slightly curved, short yet long enough to reach to the desired depth in almost any case that will be likely to fall under the observation of the practitioner. Selecting the most prominent, and, if possible, also the most dependent, portion of the abscess, the instrument is plunged perpendicularly through the skin, into the very midst of the matter, its arrival there being indicated by the want of resistance and the escape probably of a few drops of fluid, especially if this be rather thin. The puncture thus made is then converted into an incision, by depressing the handle of the bistoury, and cutting from within outwards, the length of the opening varying, on an average, from a third of an inch to an inch, according to the volume of the abscess. In general, it is better that the opening should be too large than too small, as the object always is to afford free vent to the pent-up fluid.

Fig. 16.



Bistoury.

Care, of course, is taken, in introducing the bistoury, not to interfere with any important vessels and nerves, or to perforate any important cavity.

Penetration having been effected, the matter usually escapes of its own accord, simply by the pressure of the atmosphere; but the evacuation may be aided, if necessary, by the hand or finger, used, however, with the greatest gentleness, otherwise it may not only cause severe pain but an aggravation of the inflammatory action. Too much caution, indeed, cannot be observed in this particular. Nothing can be more reprehensible than the rude manipulations which we so often see practised after this operation, even by surgeons otherwise well educated. To prevent the incision from healing by the first intention, and the necessity of the repeated use of the knife, a small tent, well oiled, made of old linen, is interposed between its edges, one extremity being carried a short distance into the now empty sac, and the other left slightly pendent externally, substitution being effected once in the twenty-four hours. The best application for the surface of the abscess is an emollient cataplasm or the warm water-dressing; but this should not be made until bleeding has ceased, otherwise a troublesome hemorrhage might ensue. As soon as the parts have become perfectly comfortable, the warm dressing is discontinued, on account of its relaxing tendency, a piece of lint, spread with simple cerate, or wet with olive oil, being used in its stead.

When the abscess is seated in a bone, evacuation must be sought with the trephine; but the operation is not always certain of success, owing to the difficulty of the diagnosis.

When the abscess is of large size, or when it has been productive of extreme separation of the muscles, its sides should be approximated, after evacuation, by means of a thick and well-adjusted compress, secured by adhesive strips, or, in the event of the abscess being seated in an extremity, by the common roller, extending upwards from the distal part of the limb; care being taken not to interfere with the artificial opening. In this way a cavity that would not otherwise close under several weeks, will often be effectually obliterated in a few days.

An abscess is sometimes prevented from healing by the unfavorable position of its opening, whether natural or artificial, the matter accumulating in a kind of sac, situated between the orifice and the bottom of the swelling. Such a state of things calls for what is termed a *counter-opening*, which is easily established by making an incision at the most dependent part of the sac, upon the end of a grooved director, introduced through the previous and now useless aperture. Counter-puncture is often necessary in abscess of the neck and parotid region, from the gravitating tendency of the matter in these situations. Sometimes, again, an opening of this kind is called for on account of the change in the position of the part after the first operation, performed perhaps well enough at the time. Whatever may be the circumstances demanding it, patency is maintained with more care, if possible, than under ordinary circumstances.

Again, reparation may be rendered tedious, if not impracticable, by

the existence of a *sinus*, extending, perhaps, deeply among the surrounding parts, or, it may be, communicating with some natural cavity. When this is the case, the most speedy and effectual remedy is incision with a bistoury upon a grooved director, inserted into the bottom of the track, the parts being thus laid into one, and permitted to heal by granulation, readhesion being prevented by the constant interposition of a piece of lint. In the milder cases, steady and systematic compression sometimes succeeds in obliterating the abnormal channel; sometimes, again, gently stimulating injections are useful; and, finally, there is a class of cases where the seton is worthy of trial. In general, however, these means only serve to amuse the patient, and annoy the surgeon, who is at last compelled to have recourse to the remedy which his judgment tells him he should have employed in the first instance.

Hemorrhage is not common after this operation, but it may take place in spite of the utmost precaution on the part of the surgeon, and may prove quite troublesome from the difficulty of finding its source. The proper remedy is the ligature, the vessel being seized and drawn out with the tenaculum, or surrounded with a curved needle. Gentle compression sometimes answers the purpose, especially if the bleeding be venous, or proceed from a number of small points. If a considerable sized artery has been laid open, and cannot be easily reached, the incision should be dilated to effect the necessary exposure.

The healing of an abscess, whatever may be the manner in which it is evacuated, is effected by the contraction and approximation of its walls, which generally begin the moment the matter has escaped, and steadily progress until the sac is completely obliterated. The raw state of the opposed surfaces strongly predisposes them to unite with each other; an occurrence which is always favored by an effusion of plastic substance. If the cavity of the abscess were obliterated, as was formerly supposed, by granulations, the part would remain hard and prominent for a long time; but this is not the fact. On the contrary, it soon shrinks, becomes soft, and drops down to a level with the surrounding surface. The opening alone unites in this way; but even this is not always so, for cases constantly occur where it closes by the first intention.

Although, as a general rule, the outer wall of the abscess soon recovers its pristine softness and pliancy, yet occasionally the reverse is true, the parts remaining hard, tender, and enlarged, being seemingly reluctant to throw off their inflammatory burden. To expedite resolution, the affected surface may be covered with a gum ammoniac and mercurial plaster, probably the very best remedy that can be used for the purpose; or rubbed several times a day with some sorbefacient liniment, unguent, or embrocation, aided, perhaps, by the bandage and a few alterative doses of mercury.

2. DIFFUSE ABSCESS, OR PURULENT INFILTRATION.

The above is one variety of phlegmonous abscess; the circumscribed, in which, united with rapidity and severity of action, the matter is

bounded by a distinct wall of fibrin, serving the purpose of a cyst, although in reality there is no such formation. In the present variety, already incidentally adverted to, there is no connective exudation, and the consequence is that the pus is widely diffused among the surrounding structures, dissecting and separating them from each other in the most frightful manner. Such collections, which are generally attended with intense suffering, are often described under the appropriate and expressive appellation of purulent infiltration.

The diffuse form of abscess is met with under a great variety of circumstances, both as it respects the nature of the exciting cause and the condition of the general system. It is most common in persons whose constitution has been dilapidated by intemperance in eating and drinking, by want and exposure, and by organic affections of the heart, lungs, liver, bowels, and kidneys, leading to anemia, obstructed circulation, and exhaustion of the vital powers. When such persons meet with a serious accident, or suffer from a prolonged attack of fever, suppuration is extremely prone to take on this kind of action, often sadly complicating the original disease. Diffuse abscesses are also sufficiently common after severe injuries, as compound fractures and dislocations, lacerated, railway, gunshot, and dissection wounds, and capital operations, especially amputations of the larger limbs and resections of the bones and joints. Persons of a scrofulous constitution are, on the whole, more liable to suffer from diffuse suppuration than any other class of individuals, their vital powers being too feeble to enable them to furnish a sufficiency of fibrin to limit the purulent matter that is so often effused under the above circumstances.

Diffuse abscesses may occur independently of any other appreciable disease, or they may take place in conjunction with erysipelas, pyemia, or phlebitis, which they resemble very much both in their mode of origin and in the character of their symptoms. Their presence, in fact, is always denotive of a bad, or depraved state of the system; in some cases the fault apparently lies in the blood, either in a defect of some of its more important constituents, or in the ingress of some morbid poison; in others, again, it seems to depend upon imperfect action of the skin and kidneys, excess of food and drink, the respiration of impure air, over-action of the brain, or exhaustion of the nervous system.

The symptoms of this variety of abscess are ordinarily bold and well defined. In general, the disease is ushered in by considerable shivering, if not by a severe rigor, followed by heat and perspiration; the pulse soon becomes small, quick, frequent, and irritable, the extremities are cold, the urine is scanty and high colored, the appetite is destroyed, the tongue is covered with a brownish fur, the strength rapidly fails, and the patient soon sinks into a state of delirium. Great irritability of the system exists; the pain is often excessive, sleep is interrupted, and the mind is peevish and fretful. Frequently the symptoms are of a typhoid character from the beginning; if not, they are sure soon to become so; and yet not merely typhoid, but typhoid and irritative, the two classes being generally well balanced throughout.

The local symptoms are those of ordinary inflammation, only that

they are more severe, especially when the matter is deep seated. The discoloration is of an erysipelatous nature, the parts are swollen and pit on pressure, the pain is smarting and pulsatile, and the skin feels hot, stiff, and numb. If the matter lies immediately beneath the surface, or among the more superficial muscles, a boggy sensation will be imparted to the hand of the examiner, and a little pressure will be sufficient to push the fluid about from one place to another, sometimes to a distance of many inches. When, on the contrary, the pus lies far below the surface, being bound down by muscles and aponeuroses, its early detection will generally be very difficult; under such circumstances, the best guide to its situation will be the history of the case, the deep-seated pain, the presence of œdema of the skin and areolar tissue, and the character of the constitutional phenomena. If any wounds or sores exist, they speedily dry up, and assume an unhealthy appearance.

Any part of the body may become the seat of diffuse abscesses, but their most common situations are the limbs, in which the matter often burrows to a great extent, both beneath the integuments and among the muscles; in some of the worst forms that I have ever seen, it lay in immediate contact with the bones, separating them from the soft structures, and even from the periosteum. In a case, which was under my observation some years ago, the purulent fluid had spread along the posterior surface of the lower extremity, in close contact with the femur and the bones of the leg, from the hip as far down nearly as the heel.

The matter which accompanies this variety of abscess is always of an unhealthy character; it is generally thin, sanious, irritating, acrid, and excessively offensive, often tainting the atmosphere of the apartment for many feet around, and fastening itself upon the hands and clothes so as to be perceptible for hours afterwards, notwithstanding perhaps the liberal use of the chlorides. In fact, the stench is usually of the most disgusting character. In some cases the fluid approaches more nearly to the properties of ordinary pus, but this is uncommon. Occasionally extensive sloughs form, especially in the cellular tissue; so that the disease may be said to partake of the character both of suppuration and of gangrene.

The prognosis of this form of abscess is generally most unfavorable, there being few constitutions that can withstand its depressing effects. The very fact that such a disease is in operation shows, as already stated, that the system is in a depraved condition; and when it is recollected that some of this foul matter must necessarily find its way into the circulation, contaminating everything with which it comes in contact, it is not difficult to anticipate what the result will be likely to be, even when the purulent collection is not very extensive, especially in persons already exhausted by shock, loss of blood, or lesion of some important organ.

The treatment of diffuse abscess is sufficiently obvious. The leading indications are to evacuate the matter, and to support the system. The first is fulfilled by early and free incisions, practised at the most favorable site for ready drainage, with the precaution of avoiding

hemorrhage, the smallest quantity of which is sometimes sufficient, under such circumstances, when life is, as it were, quivering in the balance, to bring on fatal exhaustion. Counter-openings are often necessary. After the fluid has been thoroughly evacuated, recourse is had to the bandage, for the purpose of effecting approximation of the sides of the abscess; a means of support which is frequently of the greatest consequence, not only in preventing the extension of the matter, but in promoting the healing of the parts. When the fluid is excessively offensive, the cavity of the abscess should be well syringed several times a day with tepid water, charged with a suitable quantity of liquid chlorinate of soda, which, while it will allay fetor, will be instrumental in imparting a healthy action to the disabled structures. If sloughs form, they should be speedily removed, the knife being used, if necessary, to effect their separation. The parts are placed in a proper position for facilitating drainage; and are enveloped in warm water-dressings, or emollient poultices, medicated with acetate of lead and opium.

Among the more important internal remedies are anodynes, quinine, ammonia, iron, and brandy, with animal broths and jellies, and a pure atmosphere, which is of paramount importance to the recovery of the sufferer. For this purpose, the windows and doors of the apartment should be frequently thrown open, the dressings changed, and disinfecting agents used. Anodynes are indispensable to allay pain and induce sleep, and should be administered in full doses, either in the form of morphia, opium, or black drop. The best tonics are quinine and brandy, given in the same manner as in typhoid fever; the tincture of the chloride of iron, in doses of from fifteen to twenty drops, every three or four hours, will also be of service; and, in many cases, ammonia, in camphor mixture, will meet the exigencies of the case better than almost any other remedy, especially when there is hiccough with twitching of the tendons.

3. SCROFULOUS ABSCESS.

The scrofulous abscess is of such frequent occurrence, and possesses, withal, such distinctive features, as to entitle it to separate consideration. It is known by various names, some of which have reference to its progress, some to its symptoms, some to the nature of its contents, or to the state of the constitution which precedes and accompanies its formation. Thus, it is often described as the chronic abscess, tardy development being one of its characteristic features; the word cold is frequently employed on account of the absence of inflammatory symptoms; but scrofulous is the appellation by which it is generally known at the present day. As implying the same thing, the terms strumous and tubercular are much in vogue. There is a form of this abscess to which the name *congestive* has been applied, from its tendency to change its position, although it is impossible to discover any etymological fitness in the expression.

The scrofulous abscess is altogether a singular production; singular in its origin and progress, and singular in respect to its treatment. It

is never met with, except in the strumous constitution. The phlegmonous abscess is common to all persons, of every age, grade, and condition in life; the scrofulous, on the contrary, can occur only in persons who have a predisposition to scrofulous affections, whom nature has stamped, so to speak, with a peculiar diathesis, or state of the system, rendering them prone to phthisis, coxalgia, caries of the spine, and other kindred maladies. Its sphere of action is, therefore, comparatively limited, a hundred cases of phlegmonous abscess occurring to one of a scrofulous character.

The progress of scrofulous abscess is peculiar. It is always slow, weeks and months often elapsing before it acquires any considerable bulk. Hence the term chronic, by which it is so frequently designated. Phlegmonous abscess, on the contrary, is always rapid in its progress, generally attaining its full development in a very short time. Another peculiar feature of the strumous abscess is the absence of the ordinary inflammatory symptoms. There is neither heat nor redness of the skin; instead of this, the surface is cold and blanched, the part feeling and looking as if there were great deficiency in its circulation. Hence this variety of abscess is often termed cold, especially by the German surgeons, who were the first to describe it. Pain, too, is absent, or, if it exist, it is so slight as hardly to attract attention. Functional disorder also is very slight, especially in the earlier stages of the disease. Looking at the constitution, we find the same uncommon train of phenomena. The general health may be somewhat impaired; the strength may slowly and almost imperceptibly decline; and the countenance may have a pale, sallow appearance; but there are none of the open and well-marked inflammatory symptoms which attend the march of a phlegmonous abscess, and which, especially when the disease is located in an important internal organ, suggest the idea of great and immediate danger. Thus, as far as appearances are concerned, the affection is one seemingly of little moment; its discovery is often purely accidental, and, for a while, both patient and surgeon may be wholly unconscious of its true character. It is, indeed, as completely different from the ordinary abscess as it is possible for one disease to be from another. Scarlatina and measles are not more unlike each other.

The strumous abscess is very frequent in the lymphatic ganglions, subcutaneous cellular tissue, and dorso-lumbar region. The testicle and liver are also sometimes its seat. In the lungs, however, it is more common than anywhere else, being the immediate product of the softening of tubercular matter, eventuating generally in the formation of what are termed vomicæ, or pulmonary caverns. In the external parts of the body it is usually situated in the neck, on the chest, in the axilla, on the loins, in the groin, or upon the superior portion of the thigh. Large strumous accumulations sometimes form in connection with the movable joints.

Some diversity obtains in regard to the size and number of this abscess. In certain situations, as in the lungs, they are always small, but at the same time often quite numerous; while in others, as in the cervical glands, on the chest, in the groin, and on the back, they are

usually single, and from the volume of an orange to that of a fœtal head.

The strumous abscess is nearly always furnished with a distinct cyst, bag, or capsule, technically called the pyogenic membrane, which, while it serves to individualize it, separates it effectually from the surrounding parts. At what period of the suppurative process the membrane begins to be formed is not determined, but that it is developed at an early stage is unquestionable. It has been supposed, singularly enough, that its formation, at times, precedes the deposition of the pus; but for such an opinion there is not, so far as I can perceive, any well-founded reason. The subject, however, does not admit of easy demonstration; for it is seldom that we have an opportunity of inspecting an abscess of this description until after it has attained considerable bulk, and the membrane has acquired some degree of development. The most plausible conjecture that can be framed respecting it is, that the membrane is formed out of the necessity of the case, nature intending it as a means of limiting the diffusion of the pus, which would otherwise inevitably happen in consequence of its tardy but steady deposition. To accomplish this object she sets up around the purulent depôt, at an early period of the morbid action, a species of adhesive inflammation, by which, in the first place, the cells of the neighboring tissues are effectually occluded, the process being precisely similar to that which occurs in an ordinary phlegmonous abscess. Thus, the secretion is temporarily circumscribed, but, as may readily be perceived, the barrier thus opposed would soon yield before the accumulating burden, and thus thwart nature's intentions. To prevent this a wall of plastic matter is next constructed, which no amount of pus, however great, can, for a time, break down or destroy. The thickness of this wall varies from the eighth of a line to the eighth of an inch; its density steadily increases with its age, and hence it is often found to be of a fibrous consistence, with here and there a semi-cartilaginous patch. Its outer surface is rough and intimately united with the surrounding structures; the inner, on the contrary, is either perfectly smooth, or studded with minute granulations, not unlike the villi of the small intestines, only not so regular and numerous. Its vascularity, which is always considerable, is easily distinguishable by the naked eye, as well as by minute injection. It also, no doubt, contains nerves and absorbents, although none have yet been demonstrated.

No one can reflect upon the structure of this membrane without being impressed with the conviction that it is invested with important functions. In the first place, as has already been stated, it protects the tissues in the immediate neighborhood of the abscess from the diffusion of its contents; a circumstance which could not fail to be productive of great injury, inasmuch as the matter, burrowing about in different directions, might occasion extensive separation of the muscles, which it would afterwards be extremely difficult to remedy. Secondly, the membrane is an important secreting structure, since it furnishes the matter which it incloses, not directly, but through the agency of lymph, which is speedily transformed into pus. Thirdly, it is also an absorbing structure, as is proved by the fact that the matter which it

contains occasionally entirely disappears, either spontaneously, or under the influence of treatment. Finally, the membrane possesses important sympathies with the rest of the system. Let alone, it silently enjoys its parasitic existence, preying upon the parts around without any serious general detriment, but the moment it is opened or disturbed by rough manipulation, it resents the aggression, and is sure to give rise to severe constitutional derangement.

The pus of the strumous abscess is generally of a whitish or yellowish cast, slightly inclining to greenish, of a tolerably thick consistence, free from odor, and intermixed with caseous particles, looking and feeling very much like pieces of soft-boiled rice. Instances occur, especially in scrofulous disease of the lymphatic ganglions of the neck, where it is very thin, pale, and full of curdy substance, consisting apparently of imperfectly broken-down tubercular matter. When long retained, or situated near the ano-rectal region, scrofulous pus is sometimes excessively fetid, either from actual decomposition, or the presence of sulphuretted hydrogen. If it be permitted to stand for some time, it separates into two parts, one of which is thin, whey-like, or sero oleaginous in its appearance, the other thick and curdy, the former being always upon the top of the latter. Like the pus of the phlegmonous abscess, it occasionally, although rarely, contains the debris of the organs in which it is formed, and also some of their peculiar secretion. Thus, a strumous abscess of the liver occasionally contains bile; of the breast, milk; of the spine, osseous particles.

In regard to quantity, there is much variety in the pus of this form of abscess. In psoas abscess, which is one of the best examples of the disease, the accumulation is sometimes enormous, reaching several quarts, or, perhaps, even a gallon. In scrofulous abscess in the glands of the neck, there is also occasionally a good deal of pus, although, in general, it is small. Large collections of strumous matter are sometimes seen in chronic abscess beneath the skin, especially in the lower extremity. A young woman, a patient at the College Clinic, had an abscess of this kind on the left thigh, containing nearly a gallon of pus.

The diagnosis of this form of abscess may be gathered from the remarks which have been made respecting that of phlegmonous abscess. The only two affections with which it is at all likely to be confounded are encephaloid and aneurism; but from these it may usually be easily distinguished by the history of the case, the fluctuating character of the swelling, and, if necessary, the use of the exploring needle.

Treatment.—The treatment of this abscess differs essentially from that of the phlegmonous. In the latter, the system often bears energetic measures; in the former, seldom, if ever; in the one, the surgeon does not hesitate to make an early and free incision into the swelling, with a view to the early evacuation of its contents; in the other, he waits and hesitates, well knowing that such an operation is often the prelude to serious constitutional disturbance, if not death. The one is the work of a few days, or, at most, of a few weeks, taking the part and system, as it were, by surprise, and, therefore, requiring prompt interference; the other is the work of time, affording the part and system an oppor-

tunity of accommodating themselves to its presence, and, therefore, often intolerant of interference. When the quantity of matter is small, removal is occasionally effected by absorption, the process being sometimes advantageously aided by internal and external remedies, particularly the iodide of potassium and the bichloride of mercury, together with sorbefacient plasters, unguents, and embrocations. These means are more particularly available in chronic abscesses of the glands of the neck, groin, and axilla, and in those of the mamma and subcutaneous cellular tissue. In psoas and lumbar abscesses, on the contrary, little or no benefit usually results from their employment, beyond the influence they may exert in improving the general health, and removing the strumous diathesis. When general debility exists, relief should be attempted with tonics, as quinine and iron, along with milk punch, and change of air.

Concerning the evacuation of strumous abscess, no one hesitates to interfere, when the disease is seated in the external parts of the body, as the mammary gland, the lymphatic ganglions of the neck, or the subcutaneous cellular tissue. In such cases, indeed, we can hardly make too early or too free an incision; for, not only is there, as a general rule, no danger of causing constitutional disturbance, but the procedure is eminently calculated to save structure and promote recovery. The matter being evacuated, the cavity usually at once contracts, and the tendency to secretion gradually diminishing, the part finally heals by granulation or adhesion. Besides, such a procedure always enables the surgeon to watch the morbid action, and apply his remedies directly to the affected surface.

The best local applications, after the abscess has been punctured, are emollient poultices, rendered slightly stimulating by the addition of a little common salt; or tincture of iodine, spirituous lotions, or some sorbefacient plaster, as the gum ammoniac and mercurial, soap, compound galbanum, or iodine plaster, care being taken to leave an appropriate opening for the discharge of matter. I can speak with great confidence of the beneficial effects of these plasters, especially the first, having used them for a long time in the treatment of strumous abscess of the neck, mamma, and subcutaneous cellular tissue. When the cavity of the abscess is slow in healing, in consequence of the torpor of its vessels, or the existence of a strong pyogenic membrane, nitrate of silver, nitric acid, or acid nitrate of mercury may be employed, in the form of weak injection, as local stimulants until there is a disposition to the formation of healthy granulations. Sometimes, as in the case of the subcutaneous abscess, a seton may be advantageously introduced, retention being maintained until the sac has become obliterated by inflammation. Or, instead of this, a counter-opening may be made, and a tent inserted.

When the abscess is connected with disease of the bones, as it always is when it takes the name of psoas or lumbar abscess, the treatment usually followed is that originally suggested by Mr. Abernethy, and which consists in making a valve-like opening in the most prominent and dependent portion of the swelling. The object of this procedure is to exclude the atmosphere, not that this is of itself at all injurious,

as was at one time erroneously supposed, but because its contact with the purulent matter has a tendency to cause decomposition; an occurrence which cannot fail to be succeeded by bad consequences, by awakening all the constitutional sympathies of which such a disease is capable. Educated in a school in which this practice was strongly inculcated, and warmly prepossessed in its favor, on account of the high authority of its originator, I was led to expect from it all that the most sanguine feeling could anticipate; but, after an experience of upwards of twenty-five years, I am compelled to say that it has utterly disappointed me, in the only class of cases to which, in my judgment, it is at all applicable. I cannot, in truth, recall to my mind a solitary instance in which I have found it productive of the least permanent benefit. My experience is that the opening, however judiciously made, will, at no distant day, be followed by ulcerative action, leading thus to all the bad effects that are usually caused by making a free incision in the first instance. I believe that this generally occurs, whatever may be the amount of matter evacuated, whether small or large, and whether the operation be repeated at long or short intervals. It has appeared to me that any interference, however trivial, is always sure to be resented, and that, instead of benefiting the case, we only render it worse. Hence, I am satisfied that, when the pain from the pressure of the accumulated fluid is not so great as imperatively to demand its withdrawal, it is best, as a general rule, to let the part alone, patiently waiting for spontaneous evacuation, and the accommodation of the part and system to the approaching event.

When artificial evacuation becomes necessary, it may be effected simply with the knife, the trocar, or the knife and trocar together. Whatever instrument is employed, care is taken to carry the point some distance between the skin and sac, before the latter is penetrated, so as to give it the valvular form so much insisted upon by the advocates of this mode of treatment. From two-thirds to four-fifths of the matter having been withdrawn, the orifice is carefully closed with two broad strips of adhesive plaster, arranged crucially, and supported by a compress and bandage. The operation is repeated from time to time as the fluid reaccumulates, an opportunity being thus afforded the abscess to contract, and finally to obliterate itself; an event, however, that is certainly extremely rare.

It was proposed, some years ago, to open these abscesses while the patient's body is immersed in water, on the ground that there would thus be less likelihood of the introduction of air; but we may well ask whether the ingress of the former fluid would not be quite as injurious as that of the latter? The truth is, it is hardly possible to perform the operation without some risk of this kind; still, if proper care be taken, the quantity will be so small as not to produce any serious mischief.

As to iodine injections, which have been recommended for the radical cure of this form of abscess, the experience of the profession has nothing to offer in their favor. The practice, considered in a purely theoretical point of view, is sufficiently plausible, since its object is to change the character of the secerning surface of the

pyogenic membrane, by inviting an effusion of plastic matter, which shall lead to the obliteration of its cavity. It was evidently suggested by the beneficial effects which are known to follow the use of iodine injections in hydrocele and other kindred affections, but to insist upon a similarity of structure of the sac of a chronic abscess to that of the vaginal tunic of the testicle certainly displays a very limited and imperfect knowledge of morbid anatomy. It is not surprising, therefore, that the practice should have failed, and that its employment should have been attended, in most cases, with considerable risk, from the tendency which it has to create undue irritation both in the part and system.

Whatever mode of treatment be employed, it is of paramount importance to sustain the system by tonics and to allay pain by anodynes.

4. MULTIPLE ABSCESS, OR PYEMIA.

The fact that some injuries and operations are occasionally followed by the development of abscesses in some of the internal organs of the body did not escape the attention of some of the older surgeons. Ambrose Paré makes distinct mention of the occurrence; and Pigrai, about the same period, had an opportunity of noticing that, during one particular year, nearly every person who was so unfortunate as to have a wound of the head died of suppuration of the liver. These observations were afterwards confirmed by Morgagni, Bertrandi, and Andouillé; and, more recently, by Schmucker, Kern, Klein, Hennen, Larrey, Guthrie, and other military surgeons, as well as by many hospital and private practitioners. Mons. Velpeau, however, was the first to investigate the lesion in a really scientific manner, and to institute a thorough and elaborate examination into its etiology, pathology, and treatment.

The name pyemia, by which this affection is now generally known, literally signifies an alteration of the blood by pus, or, perhaps, more properly speaking, an admixture of the two fluids, giving rise to what has been called septicemia or purulent infection. It is a corruption of pyohemia, first applied to this disease by Piorry, and is synonymous with ichorhemia, a term recently introduced into pathology.

The exciting causes of pyemia, or blood-poisoning, are not only numerous but of a highly diversified character; they may be stated, in general terms, to be such as are productive of great shock to the system, loss of blood, or depression of the vital powers. As following severe injuries of the head, it was, as already stated, long ago noticed by many of the older pathologists and surgeons, although they failed to offer any correct or even plausible theory of its occurrence. Since attention was first prominently called to it, in 1823, by Velpeau, it has been much oftener noticed after compound fractures and dislocations, lacerated, contused, and gunshot wounds, and amputation of the larger limbs, than after any other accidents. In lying-in females it is also sufficiently frequent, and is, in fact, a considerable source of the mortality consequent upon the puerperal state. It has been known to supervene upon erysipelas, carbuncle, smallpox, scarlatina, and

typhoid fever. One of the first cases of the disease I ever saw occurred, many years ago, in a young woman who had an attack, apparently not a severe one, of erysipelas of the leg. On dissection, I found a sufficient cause for death in a pyemic abscess in the left lung, about the volume of a large almond, filled with plastic matter, and surrounded by highly inflamed and softened pulmonary tissue. No appreciable disease existed in any other part of the body. The secondary purulent collections so often met with in glanders and dissection wounds evidently belong to this class of affections. Pyemia occasionally succeeds to the use of the trephine, the extirpation of tumors, lithotomy, lithotripsy, the perineal section for the cure of stricture of the urethra, and the operation for aneurism. Sometimes, indeed, apparently the most trifling operation is followed by it. In 1831, I attended, in consultation, a man who lost his life by blood-poisoning consequent upon bleeding at the bend of the arm; and a similar case occurred a number of years ago in my own practice at the Louisville Marine Hospital. The patient, a colored woman, laboring under chronic disease of the wrist-joint, was bled, at my request, by the resident physician, at the median basilic vein. In a few days violent phlebitis supervened, followed by large purulent collections in nearly all the great joints, as well as among the muscles of the arm and shoulder, terminating in death in less than a week. The injury inflicted in the removal of a small piece of dead bone has been known to cause death by ichorhemia. In 1848, I lost a young man, twenty-eight years of age, from pyemia, brought on by tying three hemorrhoidal tumors. Death occurred on the eighth day; and, on dissection, I found the cellular tissue of the meso-rectum studded with hundreds of abscesses, from the size of a currant to that of a small pea.

Pyemia occasionally follows the suppurative inflammation consequent upon a badly-healed stump, perhaps weeks and even months after the amputation, and long after the patient is apparently out of all danger. The discharge, perhaps never entirely arrested, suddenly increases in quantity, the parts become tender and irritable, the constitution is seriously affected, rigors soon set in, and, in short, all the symptoms of blood-poisoning are fully declared.

No period of life is probably entirely exempt from the attacks of this disease. It has been met with even in children at the breast. A case has been reported of an infant, only ten days old, in whose body, affected by erysipelas, not less than nine large abscesses of this kind had formed, causing death in a short time. On the other hand, it occasionally appears at a very advanced age. Young and robust subjects, however, have appeared to me to be most liable to it, especially after severe railway and other accidents, attended with severe shock and a good deal of loss of blood. Wounds of, and operations upon, the veins are very prone to be followed by blood-poisoning. There can be no doubt also that pyemia is more common among the inhabitants of crowded cities than among those who enjoy the benefits of pure country air, good wholesome food, and an abundance of exercise and sleep; it is likewise more frequent in hospitals, almshouses, and other receptacles for the poor than in private practice; circumstances

of no little interest both in an etiological and therapeutic point of view.

Such being some of the remote causes of pyemia, the question may now be asked, what are the immediate causes of the disease, or the circumstances whose operations are more directly concerned in its production? The subject has led to much speculation; and, although it has been ably discussed by a number of enlightened pathologists, yet it must be confessed that our knowledge respecting it is still extremely meagre and unsatisfactory.

The old notion that pyemia is the product of metastasis; or, in other words, that it is due to the absorption of pus from the part originally affected, and to the transportation of this fluid to some other, more or less remote situation, where it is collected into a focus, and thus becomes a source of new irritation and disease, has still its advocates and adherents. It rests upon the supposition that the pus corpuscles are admitted, unchanged, into the open mouths of the veins at the seat of the wound, as, for example, the surface of a stump, and that, being so introduced into the circulation, and pushed onward by the blood, they are finally arrested in the minute capillaries, which are unable to transmit them, as they do the red particles of the blood, in consequence of their larger size. The mechanical obstruction thus caused forms, it is alleged, a new cause of morbid action, which is soon followed by the development of an abscess, or a deposition of pus, and, if the new depôts be numerous, by purulent infection. In opposition to this doctrine, it has been contended that pus corpuscles never gain access in this way into the circulation, and that those who profess to have seen them there were deceived by the resemblance which these corpuscles bear to the colorless globules of the blood. Moreover, it is asserted that there is nothing in the corpuscles of healthy, laudable pus of an irritating nature, and that, even supposing they got into the veins, it would not be possible for them to occasion multiple abscesses.

Cruveilhier, from some experiments which he performed on the inferior animals, as dogs, came to the conclusion that pyemia and multiple abscesses might be induced by any irritating fluid, accidentally introduced into the system, and incapable of spontaneous elimination. On injecting ink, mercury, and other substances into the blood, he found that purulent depôts occurred wherever the extraneous substance became impacted in the minute vessels. Granting that these experiments caused precisely what has been alleged of them, it is difficult to see why they should have been brought forward as a proof of the manner in which pyemia is developed in the human subject. There is certainly no similarity, hardly, indeed, any analogy, between the substances used by Cruveilhier in his experiments upon dogs and those that are formed in a suppurating wound, or on the surface of a stump after amputation.

Mr. Henry Lee, of London, in a small treatise on the Origin of Inflammation of the Veins, published in 1850, advanced the ingenious, and, at first sight, very plausible, idea, that these purulent deposits are essentially due to the coagulation of the blood in consequence of the admixture of pus within the veins. He found that

when healthy, recently-drawn blood was mingled with pus, it solidified more rapidly and more firmly than under ordinary circumstances; and, coupling this occurrence with the well-known fact that the veins are often obstructed by large clots in phlebitis, he concluded that coagulation must be the first link in the chain of morbid action. The inspissated blood, unable to make its way through the living body, would, Mr. Lee thinks, soon adhere to the sides of the vessels, which would thus become so many centres of inflammation and purulent deposits. It will be perceived that this theory, like that of the older pathologists, previously adverted to, rests essentially upon the idea that pus may pass bodily into the veins, or, in other words, without any change in its composition, and that it differs from it only in assuming, what is doubtless true, that it possesses the power of coagulating the blood with which it comes in contact.

Finally, there is another class of pathologists who attempt to account for the formation of purulent deposits by supposing that they are caused by the development of a peculiar poison, derived from certain kinds of pus, which, entering the circulation, contaminates the blood and solids, and thus brings about that adynamic and atonic state of the system so characteristic of pyemia. According to this doctrine, which has found one of its ablest advocates in Professor Bennett, of Edinburgh, pus corpuscles do not enter and mingle with the blood, what have been taken for these bodies by various observers being merely so many colorless cells of the blood, the distinction between the two being often extremely difficult, if not impracticable.

Of the foregoing explanations the last, it seems to me, is not only the most plausible, but also the most consistent with facts. Without denying, as is the case with its advocates, that it is impossible for pus corpuscles to enter the circulation, it is unquestionable that the more attenuated and watery parts of pus; or, perhaps, more correctly speaking, the more ichorous, sanious, or sanguinolent varieties of this fluid, frequently become commingled with the blood in suppurating wounds and in the stumps of amputated limbs, thereby speedily and thoroughly contaminating both solids and fluids, and, consequently, effectually undermining the constitution. It is not improbable that this poisonous matter, soon after its admission into the circulation, excites inflammation in the capillary vessels, as well as in some of the larger veins, rapidly followed by deposits of fibrin and pus, or the development of purulent collections. The coagula, so often met with in the veins of those who die of this disease, are a direct result of this inflammation, their formation being favored by the plasma thrown out by the inner surface of the affected vessels. The occurrence, in fact, is similar to what takes place, at times, in inflammation of varicose veins in the lower extremities of laboring people, which are occasionally completely clogged up in this way. Thus, I think it is not unlikely that the first link in the chain of morbid action in this affection is a poisoned and disorganized state of the blood; the second, the development of inflammation in the capillaries and veins; the third, the formation of adherent coagula, clots, or concretions; and the last, as the necessary and inevitable effect of the others, a deposition of pus, or pus and fibrin.

Is pyemia always, as the name denotes, a result of the admission of vitiated secretions, or putrescent matter into the circulation? Instances occur, as when the disease complicates typhoid fever, scarlatina, and asthenic and other affections, where the reverse would seem to be the case, and yet, it must be confessed, it is not always possible, even here, to determine whether the individual is entirely free from antecedent suppurative action. It is probable that, under such circumstances, a mere disordered state of blood, such as undoubtedly attends the worst forms of these maladies, may be quite adequate to the production of secondary abscesses of a very bad character.

The period of latency of pyemia is often, if not generally, very short, frequently not exceeding a few days from the time of the accident or operation giving rise to it. There are cases, however, in which a much longer time elapses, although they are uncommon. As a general rule, it may be assumed that the briefness of the period of latency will be in proportion to the shock of the system, the amount of hemorrhage, and the ill state of the patient's health prior to the injury. The period is usually shorter in traumatic than in idiopathic affections, in the latter of which the secondary lesion occasionally does not come on until near the time of apparent convalescence.

The approaches of pyemia are generally very stealthy and insidious; hence it often happens that the young and inexperienced practitioner is thrown completely off his guard in respect to the nature of the formidable disease with which he has to grapple. If the case is one, for instance, consequent upon an amputation, he probably feels concerned to find that the stump gives evidence of being in an unhealthy condition; that it is unusually tender and painful, that it manifests no disposition to heal, and that the discharge is not only profuse but of a thin, sanious, bloody, or ichorous nature. The patient, although not inclined to complain much, is restless and ill at ease, looking pale, sallow, and anxious, as if some serious evil were impending. His pulse is irritable and too frequent, the cheek is marked by a sinister flush, the appetite is impaired, and the secretions are deranged. This prodroma is of short duration; often hardly lasting twenty-four hours. Violent rigors now set in, which, after having continued for a period varying from fifteen minutes to half an hour, an hour, or even two hours, are succeeded by violent reaction, and this, in its turn, by profuse sweats, often completely drenching the surface and even the body clothes. These rigors may return several times in the twenty-four hours, or they may come on at regular periods, not unlike the paroxysms of an intermittent fever, for which the unwary sometimes mistake them. Their severity is not always the same; cases occur in which they are replaced, as it were, by chilly sensations, alternating with flushes of heat, and not unfrequently lasting for several days together. In whatever manner this outbreak of the disease is displayed, the case at once assumes a more bold and decisive character. The conjunctiva and skin exhibit a well-marked icterode appearance; the features are shrunken and withered, the nose being pinched and the eye sunk in its socket; the pulse is small, frequent, and feeble; the breathing is accelerated and

performed with unusual effort; the tongue is dry and clammy; the thirst is urgent; the sleep and appetite are interrupted; the bowels are irregular, being at one time relaxed, and at another constipated; the stomach is irritable and nauseated; the urine is high-colored and scanty; the extremities are cold; the mind wanders; and the body is often racked with excruciating pain, especially in the joints and muscles, which are not unfrequently exquisitely sensitive to the slightest touch. Occasionally the patient complains of severe pain in some internal organ, to which he refers all his principal suffering. Cough is sometimes present, and when this is the case an examination of the chest generally reveals the existence of more or less serious lesion of the pulmonary tissues, or of the lung and pleura. As the disease progresses, red blotches, swollen, and excessively painful, appear over the larger joints, and serve as the forerunners of approaching suppuration in their interior, as well as in the tissues immediately around them. Similar marks occasionally show themselves in the course of the principal veins and in the situation of some of the muscles, particularly the deltoid and pectoral.

The symptoms, long before the disease has reached this crisis, are of a typhoid character, the whole system seemingly laboring under the depressing influence of a deadly poison. The downward tendency is rapidly progressive; the machinery of life moves alternately forward and backward; the pulse becomes more and more feeble; the respiration is frightfully oppressed; the body is remarkably emaciated; and the patient lies in a comatose condition, from which he is destined never to awake. This, however, is not uniformly the case; for the instances are not infrequent, where the mind retains its consciousness almost to the last. The period at which death occurs, after the disease has once fairly commenced, varies from three to ten days, or a fortnight, the average being about one week, or, perhaps, a little under.

Although there are, strictly speaking, no pathognomonic symptoms of pyemia, yet it is seldom that any one who has ever seen a case of this disease, or who has made himself thoroughly familiar with its history and progress, can possibly confound it with any other complaint. Its very mode of invasion generally sufficiently stamps its true character. The sudden, violent, and unexpected rigor; the unhealthy character of the suppurating sore or wound, if any exist; the icterode and shrunken state of the features; the rapid supervention of typhoid symptoms; the great mental anxiety and excessive restlessness; the horrible aching pains in the joints, limbs, and other regions; and, lastly, the rapid abduction of the fat, leaving the body in a wasted and emaciated condition, far beyond what occurs in almost any other affection, excepting, perhaps, cholera; are signs which, if they do not unerringly mark the nature of pyemia, will always excite the serious suspicion of the attendant, and induce him to scrutinize his case in the most careful and thorough manner. The only disease with which blood-poisoning is liable to be confounded is intermittent fever; but here the distinction is so easily drawn as to render mistake impossible, unless the most stupid carelessness is evinced by the practitioner. The diagnosis of traumatic pyemia will, in general, be less difficult

than that of the idiopathic variety, or that arising from internal causes; for the violent rigor, the icterode countenance, and the rapid prostration and emaciation will usually afford sufficient characteristic evidence of the nature of the complaint to prevent mistake.

The dissection of patients dead of pyemia reveals, as might be supposed, important and interesting changes both in the solids and in the fluids. Of those affecting the solids, the most constant are abscesses and purulent depôts in various organs, cavities, and tissues. The former, generally known under the name of *metastatic*, or multiple abscesses, are most common in the lungs and liver, then in the spleen, and, lastly, in the brain, heart, and kidneys. They sometimes occur in the subcutaneous cellular substance, and beneath the peritoneum. In one instance, previously referred to, I found an immense number in the areolar tissue of the meso-rectum. Their presence has also been detected in the prostate gland.

In regard to their number, metastatic abscesses vary in different instances. It is seldom that we find only one; most generally there are as many as twenty, thirty, fifty, or even a hundred. Sometimes, indeed, the surface of the affected organ is completely studded with them, more than a thousand having been observed in a single case, principally in the deep-seated viscera. The size of this abscess is also very variable. Some do not exceed that of a hemp-seed or garden pea; while others are as large as a hazelnut, a marble, a pigeon's egg, or an orange. When very numerous, they are usually proportionably small. In their figure they are generally oval, spherical, or angular; sometimes remarkably irregular. When seated near each other, they occasionally become confluent, like the pustules of smallpox.

The contents of a metastatic abscess are seldom of the nature of well-elaborated pus; on the contrary, they are almost always of a semi-concrete consistence, of a dirty grayish, cineritious, or drab color, and composed mainly of aplastic lymph. This is particularly true of recent cases; in those of longer standing, the contents are more decidedly purulent, but even then they are often blended with grumous blood and flakes of fibrin.

The textures immediately around the abscess may be natural, or variously altered in their appearance and consistence. In most cases they are engorged with blood, heightened in color, softened, or converted into a pulpy diffluent substance. The coats of the vessels are inflamed, thickened, and infiltrated with serosity, while their canals are filled with pus, semi-fluid blood, or fibrinous concretions. The capillary veins usually participate in the inflammation.

Purulent collections, as a consequence of ichorhemia, are most frequently met with in the chest, being rare in the peritoneal cavity, the arachnoid, and pericardium. The reason of this difference seems to be due to the fact that the lungs nearly always suffer whenever there is serious involvement of the system, whereas the abdominal viscera, heart, and brain, commonly escape in this case.

Professor Sédillot, of Strasbourg, who has studied this disease with great care, and who has combined the results of his observation in a

highly instructive and interesting monograph, published in 1849, remarks that in 100 cases of pyemia, we should find the lungs affected in 99; the liver and spleen in 1 of 12, the muscles in 1 of 15, and the heart and peripheric cellular tissue in 1 of 20: the brain and kidneys suffering comparatively seldom.

The joints often suffer very severely. In some of the cases which I have had an opportunity of examining after death, matter was found in nearly all the larger articulations, and also in quite a number of the smaller ones. In many cases the pus is situated on the outside of the joints, as well as within.

Large collections of purulent fluid are sometimes discovered in the subcutaneous and intermuscular areolar tissue; the veins also occasionally contain a considerable quantity, either lying free in their cavities, or, as is more common, commingled with the blood in the interior of fibrinous concretions.

The pus which occurs in these various localities is of the same nature as that which is contained in metastatic abscesses, properly so termed, that is, it is ill-elaborated, and intermixed with a large proportion of aplastic material. Both in the veins and in the intermuscular areolar tissue, it is generally, as just stated, interspersed through fibrinous concretions, coagula, or blood-clots, giving the latter a peculiar appearance, as if they were pervaded by small specks of lymph, or lymph and pus.

The prognosis of pyemia is most unfavorable; few patients recover, and these, for the most part, remain for a long time in a debilitated and crippled condition, liable to other attacks of disease from the slightest causes. As already stated, death usually occurs within the first week after the commencement of the malady, being apparently dependent upon the severe exhaustion consequent upon the excessive pain and obstructed circulation, which form such conspicuous features in the progress of this affection.

Treatment.—In the treatment of ichorhemia two indications present themselves to the practitioner, and these should, throughout, receive his most earnest and faithful attention. These are, first, the removal of the exciting cause of the disease; and, secondly, the support of the system, in order to enable it, if possible, to shake off the toxical influence under which it is so plainly laboring.

If the disease has been induced by an accident or operation, attended with an open, suppurating surface, much may be done, in many cases, by the promotion of cleanliness, to prevent further mischief from the ingress of purulent fluid. This object is best attained by diligent, almost incessant attention to the dressings and position of the part, the former being frequently changed, and the latter so arranged as to favor the escape of the secretions as fast as they take place. Detergent lotions are often serviceable, especially if they contain chlorinate of soda, but care must be taken that they are not so strong as to irritate, and it will be well, particularly if we have to deal with a foul stump, to throw them freely upon the parts with a large syringe, as this exerts a much better and wider influence than mere irrigation with a sponge. It will also be advantageous to keep the dressing constantly

sprinkled with the chlorides, both with a view to allay fetor and to purify the air of the apartment, which must be frequently renewed by opening the doors and windows.

To prevent the further ingress of purulent fluid into the system, is not so easily accomplished, if, indeed, it can be accomplished at all. If the surface is not too extensive, I should strongly advise the free use of a mixture of one part of the solution of acid nitrate of mercury and two parts of water, applied rapidly with a mop, the intention being not so much to produce an escharotic as an alterant effect, thereby inviting a rapid change in the action of the capillary vessels and an abundance of exudation matter, so as to close up the mouths of the vessels, and cause consolidation of the affected tissues generally. When the vessels are large and patulous, they may sometimes be closed by well regulated methodical compression, care being taken that this is applied in as gentle and uniform a manner as possible. The actual cautery, recommended by the French surgeons, for sealing the suppurating surface, has met with few advocates anywhere, and should never, I conceive, be employed for this purpose, unless it is drawn over the parts in the most careful and considerate manner, the surface being previously well wiped with soft linen to divest it of its moisture.

The second indication is best fulfilled by stimulants and tonics, as brandy, wine, ammonia, camphor, iron, and quinine, with animal broths and other suitable means of support. Opiates should be given freely to allay pain and induce sleep. The recurrence of rigors, or chilly sensations, is usually easiest prevented by quinine and morphia, the dose of the former being not less than ten grains to one grain of the latter, every four or six hours, until a decided impression has been made upon the system. No benefit can accrue, under such desperate circumstances, from administering these articles in smaller quantity, as they only serve to tease the system, and permit the play of morbid affinities. The irritability of the stomach, so often present in pyemia, is generally best controlled by sinapisms, abstinence from drink, the use of ice, and the exhibition of aromatic tincture of ammonia. Inflammation of the joints and muscles must be treated by soothing measures, as warm medicated dressings, aided by the frequent application of iodine. If abscesses form, evacuation must be afforded by early and free incisions, the openings being made in such a manner as to prevent accumulation and bagging of fluids. Determinations to internal organs, as the lungs, heart, spleen, or liver, must be counteracted by dry cupping and blistering. The secretions, generally so much disordered in ichorhemia, should be corrected with blue mass or calomel, but care should be taken not to carry these medicines so far as to excite ptyalism, which could hardly fail to produce a prejudicial effect upon the progress of the case.

Bleeding, both local and general, is invariably, so far as my observation extends, inadmissible in all diseases attended with blood-poisoning. The system, oppressed and borne down by the toxical influence, needs all the support it can derive from this fluid; the whole current, it is true, is vitiated, and its life-power greatly impaired, but, although

this is the case, no sensible practitioner would attempt to improve the condition of the affected part by such a procedure. Good nourishing food and drink, with supporting medicines, alone can be confided in under such circumstances, when the loss even of a small quantity of blood would inevitably hasten the fatal crisis.

When marked tendency to hemorrhage exists, in consequence of a dissolved and broken-down state of the blood, recourse must be had to some of the preparations of iron, especially the tannate and tincture of the chloride; the former being given in doses of from five to ten grains, and the latter of from fifteen to twenty drops, in a suitable quantity of water, every three or four hours. The same remedies will generally answer excellently well for suppressing the copious sweats so often present in the different stages of pyemia. Sometimes acids, as the nitric and sulphuric, may be advantageously exhibited, both with a view to their tonic and their anti-diaphoretic effects.

Throughout the whole treatment, great attention should be paid to cleanliness; the bed and body clothes should be frequently changed, the surface of the patient sponged with tepid salt water, or weak chlorinated washes, and the apartment constantly ventilated. Should recovery take place, a change of air, and a rigid observance of hygienic measures, will be required to insure ultimate restoration. The convalescence will always be tardy, and the slightest exposure, or irregularity of diet, will be certain to endanger life.

5. HECTIC FEVER.

Hectic fever, although not necessarily dependent upon suppuration, is yet so closely connected with it, as a common result of that process, that it may very properly be described under the same head. Its existence is nearly always indicative of serious organic lesion, of which it, therefore, constitutes merely the general expression. The word hectic, literally signifying a bad habit of body, was originally employed to designate the peculiar train of phenomena attendant upon pulmonary phthisis, of which it forms so remarkable an attribute as to have attracted the attention of practitioners in all ages. It is, however, no longer restricted to such narrow limits; for the group of symptoms which it serves to characterize, follows a great number of diseases, accidents, and operations, and, therefore, claims the special consideration alike of the surgeon and the physician.

Hectic fever never occurs, as was once supposed, as an idiopathic affection; on the contrary, it is always symptomatic of some particular disease, generally of the presence of profuse discharge, as of pus or blood, or the development of an abscess in some important structure, as the brain, lung, or liver. One of the most remarkable circumstances connected with its history is, that it rarely, if ever, appears until the malady which it serves to represent has made considerable progress, or induced serious structural changes, along with grave inroads upon the constitution. Thus, in phthisis, it is seldom witnessed until softening of the tubercular matter is about to take place, sometimes,

indeed, not until pretty large cavities have formed; on the other hand, there are cases, as in psoas abscess, where pus frequently exists in large quantity, perhaps, for several months, and yet none of the ordinary signs of hectic fever arise. Serious as the local disease apparently is, the general system does not seem to be disposed to take any particular notice of it; the pulse, sleep, appetite, bowels, and secretions all go on in nearly their accustomed manner; and, if there be any loss of flesh and strength, the alteration is so gradual and imperceptible as almost to elude the attention even of the patient himself. But sudden and often most alarming changes occur in the constitution if, in consequence of a large opening, air is freely admitted into the cavity of such an abscess, causing decomposition of its contents. The shock is violent, and resentment of the injury is close at hand; soon a severe rigor comes on, lasting, it may be, several hours, when it is succeeded by violent fever, as this, in its turn, is followed by copious sweat. Such is not unfrequently the commencement of an attack of hectic fever, a bad habit of body, which often ceases only with the patient's life. Thus, it will be perceived that hectic fever, like every other form of fever, at least so far as we can comprehend its nature and type, is not a disease, but a symptom of disease, an expression of general suffering, dependent upon some special local lesion, not always, perhaps, appreciable by our senses, yet, nevertheless, in active operation, and effectually accomplishing its work.

In traumatic affections, hectic fever often sets in at an early period after the accident; perhaps there may have been grave shock, and profuse hemorrhage, and the two are soon followed by copious suppuration, which thus still further undermines and exhausts the vital powers; or it may be that more or less of the pus has been carried into the circulation, and that the whole system has become poisoned by the unfortunate admixture, every blood cell and every fibre and atom of solid matter feeling the baneful influence. The brief struggle which ensues may be characterized by the inflammatory type; but this is evanescent, hectic soon taking its place, and thence on steadily maintaining the ascendency, no intercurrent circumstances ever changing its real character, although they may temporarily disguise it, or for a time keep it in abeyance.

Hectic, then, is a continued, remittent fever, lasting generally as long as the cause which induced it lasts; subject to distinct paroxysms of exacerbation and remission, but at no time, perhaps, completely absent, although apparently it may be. Its outbreak is often sudden and violent, sweeping over the system with the fury of a hurricane; at other times, and more generally, it creeps on gradually and stealthily; in the former case, it is marked by severe rigors, in the latter merely by a sense of chilliness, or slight horripilations. Whatever may be its mode of attack, its actual invasion is always preceded by more or less indisposition, amounting ordinarily to a mere state of malaise, or a feeling of lassitude and discomfort, which the patient struggles in vain to throw off. His appetite and sleep are impaired; his tongue is inclined to be dry, perhaps somewhat coated; more or less thirst exists; and there

is often considerable fever, either of the inflammatory, irritative, or typhoid type. In short, hectic, like every other fever, passes through a stage of incubation, brief in one case, protracted in another. The crisis being attained, the chill appears, and thus the disease is fairly inaugurated; taking its position in the system, which, as already stated, it never abandons until the removal of the exciting cause, and often not then.

The febrile exacerbation is usually vesperal, coming on late in the afternoon, or early in the evening; lasting, on an average, from six to nine hours, and then gradually going off, to reappear, in a similar manner, about the same time the next day, thus giving the disease a distinct periodical character, not unlike that of an ordinary intermittent. Not unfrequently there are two paroxysms in the twenty-four hours; one in the evening, and the other perhaps late at night, or during the course of the morning; the latter being generally much the milder of the two. The chill ushering in the fever is often very long and severe, the patient occasionally shivering for several hours, his teeth chattering violently, and the whole body feeling as if it were wrapped in ice; at other times, as already intimated, the sensation of cold is very slight, and perhaps perceived chiefly along the spine, shoulders, and lower extremities, its duration being variable, now short, now quite protracted. The chill passing off, reaction succeeds, usually violent in proportion to the previous depression, and gradually, sometimes suddenly, merging into a profuse sweat, the harbinger of returning ease and comfort. All the secretions are again unlocked; the mouth regains its moisture; the urine is poured out in increased quantity; the thirst rapidly subsides; the pulse becomes soft and comparatively calm; and ere long the poor patient, tortured and racked with suffering, sinks into a tranquil and refreshing sleep.

In the interval of the paroxysms, the patient, although comparatively comfortable, is by no means entirely free from excitement. The pulse, in particular, is always preternaturally frequent, often even quick and small; seldom entirely normal in any case or at any time; easily disturbed by exercise and mental emotion. The countenance exhibits well-marked evidence of the inward trouble; in the morning it is pale, shrunk, and care-worn; in the afternoon, on the contrary, it has generally a somewhat full appearance, and a circumscribed blush, too plainly denotive of the vital decay, rests upon the cheeks in striking and often mournful contrast with the surrounding pallor. The eyes have a peculiar lustrous expression, and gradually retreat more and more within their sockets. Emaciation begins early, and is steadily progressive, proceeding from bad to worse, until the body is literally wasted away to a skeleton. Amidst all these evidences of decay, it is remarkable how well the appetite frequently sustains itself; the patient often eats voraciously in the intervals of his paroxysms, and digestion goes on with little or no interruption, assimilation alone being at fault. The tongue is variously affected; in general, however, it is clean, or nearly clean, but, perhaps, a little too red at the tip and edges. At times it is remarkably smooth and glossy; and cases occur in which it appears to be glazed, as if it were coated with a thin layer

of mucus. A foul tongue is a rare phenomenon in this form of fever. Hectic patients are usually easily impressed by atmospheric vicissitudes; the slightest exposure produces chilliness, and hence they always require an unusual amount of clothing. The feet and legs, in particular, are nearly incessantly cold; the hands, on the contrary, are generally dry, hot, and burning.

As the disease occasioning the hectic progresses, the symptoms gradually manifest more and more of a downward tendency; the appetite fails, the sleep is interrupted, the perspiration becomes more profuse and exhausting, aphthæ make their appearance upon the tongue and fauces, and the bowels are constantly harassed with diarrhœa, the discharges being thin, watery, and excessively fetid. Thus, the case goes on, steadily but almost imperceptibly, from bad to worse, until the patient dies literally exhausted from the want of nourishment, and perhaps also in consequence of the severity of his bodily pains. During all this struggle, it is astonishing to see how the mind, rising above the mortal decay around, maintains its supremacy; being not only clear and strong, but hopeful and often even sanguine to the last.

The prognosis of hectic fever is influenced by such a variety of circumstances as to defy anything like a definite statement. In general it promptly disappears with the removal of the exciting cause, provided the inroads made by that cause have not been productive of any serious disorganization; should this have happened, the case will probably have an unfavorable issue, the hectic continuing in a modified form down to the fatal crisis. The fortunate manner in which hectic disappears after the removal of the disease that occasioned it, is much more frequently witnessed by the surgeon than the physician, whose practice more generally brings him in contact with all kinds of incurable organic maladies. I have repeatedly seen a severe and protracted hectic, consequent upon the disorganization of a tuberculosed joint, completely vanish in less than twenty-four hours after the removal of the limb, and the system rapidly recover from the effects of the previous disturbance.

The indications in the treatment of hectic fever plainly are, first, to remove the exciting cause, and, secondly, to support the system until time is afforded to it to shake off the effects of the morbid action.

The first of these objects is frequently best accomplished by the knife, as when the disease depends upon, and has been kept up by, a tuberculosed joint, or a suppurating compound fracture, the removal of which often promptly restores health and tone to the prostrate system. If the cause be inaccessible, the case must be treated upon general principles, in the hope that, by and by, as the strength improves, the patient will have sufficient recuperative power to dislodge the source of irritation, and so rid himself of his malady.

The second indication is to be fulfilled by tonics, nutritious food, anodynes, the suppression of unnatural discharges, change of air, and attention to cleanliness.

The use of tonics is generally indispensable in almost every case of hectic, however induced, particularly in its more advanced stages, when there is a wretchedly impoverished condition both of the blood

and solids. The articles most to be relied upon are quinine, Huxham's tincture of bark, and the different preparations of iron, of which, according to my experience, the sulphate and the tincture of the chloride deserve the preference. Whatever substance be selected, its operation should be aided by a nutritious diet, consisting of the richer kinds of animal broths, jelly, tapioca, arrowroot, and milk, with brandy toddy, wine whey, ale, or porter. When the emaciation is steadily progressive, and dependent upon a tubercular diathesis, the use of cod-liver oil is indicated, and should be given in as large doses as may be consistent with the tolerance of the stomach.

Anodynes are among our most valuable agents in the treatment of hectic, as they serve to allay the inordinate action of the heart, to relieve pain and irritation, and to procure sleep, which is generally so much impaired in cases of this kind. They should be given in full doses, not too often repeated; and the best period for their exhibition is usually towards bedtime, so that their appropriate effects may be realized during the night in refreshing tranquillity. Morphine will generally be found to be borne better than opium, but when there is much sweat or diarrhœa it may often be advantageously replaced by the latter, as more likely to produce an astringent influence.

The exhausting effects of diarrhœa and perspiration, especially when they are of a colliquative character, must be promptly counteracted by suitable remedies, of which opium, as just stated, is one of the best. When the diarrhœa is dependent upon vitiated fecal matter, a mild laxative should be given, and blue mass, or calomel, in minute doses, if it has been caused by derangement of the biliary secretion. Sometimes it is most readily checked by astringents, as rhatany, prepared chalk, or tannin, in union with an anodyne.

Night sweats, which are often a source of so much prostration, will be best met by the free use of aromatic sulphuric acid, by tannate of iron, or oxide of bismuth, with frequent ablutions of the surface with tepid alum water. Sometimes they may be effectually prevented by a full opiate administered a short time before the expected rigors.

Whenever the local disease, inducing the hectic, will admit of it, exercise should be taken in the open air, which frequently conduces more to the restoration of the patient's appetite and strength, and the relief of the colliquative diarrhœa and sweats, than all other means combined. Children may be carried about in their nurses' arms, or in hand cars, while adults may ride about in a carriage, or walk, as may be most agreeable and convenient. Occasionally a residence at the seaside will be found to be eminently beneficial.

Finally, the greatest attention should be paid to cleanliness; the body should be frequently washed and rubbed; the excretions carefully and promptly removed; and the apartment thoroughly ventilated at least twice a day.

SECT. V.—HEMORRHAGE.

A discharge of blood, as an effect of inflammation, is, on the whole, an uncommon occurrence. It may take place in the interstices of the

organs and tissues, or upon their free surfaces, and is generally a result of the rupture of some of the vessels of the part, in consequence of the manner in which the blood is sent into them by the heart, at a time when their walls, weakened by the morbid action, are incapable of offering much resistance. It is probable that, when the blood is in a dissolved condition, as occasionally happens in scurvy, typhoid fever, and other low states of the system, the hemorrhage may occur as a product of secretion, or, perhaps, rather as a mechanical transudation, the fluid percolating through the coats of the vessels as water does through a bladder, the globules passing off in an altered and disintegrated form.

The fluid may present itself in a pure state; but, in general, it is mixed with other morbid products, as serum, lymph, pus, and mucus, which may thus essentially modify its properties, if not, in a great degree, mask its character. The quantity of the effused blood varies, in different cases and under different circumstances, from a few drops to a number of ounces. The largest hemorrhages of this kind commonly occur in connection with the serous and mucous surfaces, and the subcutaneous and intermuscular cellular tissue, especially in diffuse erysipelas, and in inflammation consequent upon snake-bite, in the latter of which the dissolved state of the blood powerfully predisposes to the extravasation. In scorbutic affections, where a somewhat similar condition of the fluid exists, inflammatory hemorrhages are by no means infrequent. Considerable effusions of blood occasionally take place in the air-cells of the lungs and the minute bronchial tubes in pneumonitis. In dysentery, a discharge of blood and mucus is one of the characteristic symptoms of that disease.

Inflammatory hemorrhage rarely comes on until the action of which it is a product has made considerable progress; hence its appearance may generally be regarded as denotive of a higher grade of excitement than a mere deposit of serum, plasma, or even pus. When the discharge is copious, it may, provided it do not go too far, prove serviceable in the way of depletion, answering pretty much the same purpose as local bleeding by leeching, scarification, or puncture. In general, however, it is too small to confer any substantial benefit in this way; while, on the other hand, if it be very copious, it may speedily lead to fatal exhaustion, or, at all events, to such a degree of depression as to interfere materially with recovery. Besides, it may cause serious mechanical obstruction, as when it is effused into the interstices of organs, thus sadly impeding their functions.

In the treatment of inflammatory hemorrhage our reliance is to be placed mainly upon the ordinary antiphlogistic measures, employed more or less vigorously according to the exigencies of each particular case. If the discharge be at all copious, so as to threaten exhaustion, recourse may be had to the administration of acetate of lead in union with opium, and injections of the same article, or, what will be better, of the perchloride of iron, a substance which possesses a remarkably controlling influence over all kinds of capillary bleeding, whether inflammatory or otherwise. They must, however, be used with great caution, otherwise they may do harm by their irritating

nature, thus adding fuel to the flame. Sometimes the discharge may be readily arrested by cold applications, as cloths wrung out of ice water, and frequently renewed, or by the steady employment of a bladder partially filled with pounded ice, or some refrigerating lotion. When the blood has been poured out into the cellular tissue beneath the skin, or among the muscles, and acts injuriously by compressing the capillary vessels, nothing short of free incisions will be likely to avail, and the sooner they are made the better it will be both for the part and system. When the hemorrhage is internal, proceeding from a serous membrane, as the pleura, or peritoneum, sorbefacient remedies are indicated; but, these failing, as they will be likely to do, when the deposit is uncommonly large, evacuation must be attempted with the trocar, although such a proceeding will generally be extremely hazardous, to say nothing of its inefficacy in case the effused blood has undergone coagulation, rendering its escape impracticable.

SECT. VI.—MORTIFICATION.

Mortification may be defined to be the death of a part, the rest of the organism retaining its vitality. The word, as usually employed in this and other countries, is synonymous with gangrene, so much in vogue among French writers. Formerly the term gangrene was used to denote that state of a part which immediately precedes its dissolution, while sphacelus was employed to signify the complete extinction of life, without any possibility of its recovery. When we speak of the death of a bone, necrosis is the expression which is generally used. It would save much trouble, and prevent confusion, if all these terms, excepting the first, were abolished.

Mortification may be acute or chronic, moist or dry, common or specific, according to the rapidity of its progress, the condition of the dead part, or the nature of the exciting cause. There is really no material difference between acute and moist mortification, or between dry and chronic, and hence these terms may very properly be employed in a convertible sense. The word specific implies the operation of a peculiar virus in the production of the death of a part, as the poison of the rattlesnake, of chancre, or of malignant pustule.

1. ACUTE MORTIFICATION.

Acute mortification, whether the result of traumatic or idiopathic causes, is liable to occur in all parts of the body, with, perhaps, the sole exception of the heart. There are some organs and tissues, however, which possess this tendency in a much greater degree than others, or which, more properly speaking, are better adapted to withstand its assaults. As a general rule, it may be stated that those textures are most prone to perish from the effects of inflammation which stand lowest in the scale of organization, and which, consequently, have naturally a feeble life. Hence the fibrous membranes, tendons, ligaments, cartilages, and bones, generally perish very readily,

and often to a great extent. The cellular tissue is also very liable to suffer, its areolar structure adapting it in a very special manner for the reception of morbid products, the pressure of which, inducing mechanical obstruction in its vessels, is a frequent cause of mortification in erysipelas and other forms of inflammation. When the supply of blood is cut off from the skin, in consequence of infiltration of the cellular substance beneath, this structure also dies very readily, notwithstanding its wonderful nervous and vascular endowments. Next in order come the mucous and serous membranes, the lymphatic ganglions, muscles, nerves, and bloodvessels, the latter of which, especially the larger trunks and branches, generally die with great reluctance, as is proved by the fact that we often find them retaining their vitality in the midst of the sphacelated parts, as occasionally happens, for example, in malignant scarlatina, attended with mortification of the glands and cellular tissue of the neck.

Mortification of the internal organs is extremely rare. In the lungs such an event occasionally occurs as a consequence of pneumonia, but it forms the exception, not the rule. It is likewise noticed, but still more rarely, in the liver, spleen, kidneys, uterus, and ovaries. The testicle, mamma, tonsils, and salivary glands sometimes perish from the effects of erysipelas, and the prostate from urinary infiltration. Of mortification of the heart I am not acquainted with a solitary well-authenticated instance. Gangrene of the brain, from wounds of its substance, although infrequent, is occasionally witnessed.

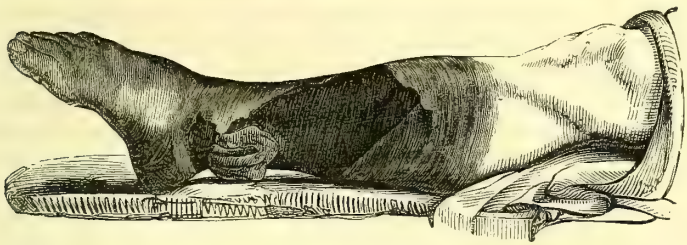
In regard to the *causes* of acute mortification, they are the same as those of acute inflammation; whatever has a tendency to produce the one may occasion the other. It is not necessary, therefore, to enter into any minute discussion respecting them, although it must be apparent that the subject is too important to be passed over entirely in silence. They may be divided, in reference to their character, into five distinct classes: 1. Intensity of inflammatory action. 2. Mechanical obstruction of the circulation. 3. Chemical agents. 4. Defect of nervous energy. 5. Constitutional debility.

I. It has already been seen how *intensity* of inflammation acts in producing obstruction in the capillary vessels of the affected part; how the blood, rendered adhesive by the increase of fibrin and white globules, becomes attached to their walls, and how these walls, softened and dilated, at length yield under the pressure of their contents, which are often, in consequence, extensively effused through the surrounding tissues, thus materially aggravating the local trouble. As the disease progresses, the capillary engorgement rapidly augments, the blood becoming more and more stagnant, and there is almost a complete suspension of the nervous fluid. In short, the utmost perversion of structure and function exists, the part is in an utterly helpless condition, circulation and innervation are entirely at fault, and death, already actively engaged at the focus of the inflammation, soon accomplishes its work.

Mortification from intensity of action is generally very rapid in its progress, a large amount of tissue, and sometimes even an entire limb, perishing in the course of twenty-four hours from the commencement

of the process. Some of the most characteristic forms of this species of gangrene are met with in compound fractures and dislocations, in lacerated, contused, railway, gunshot, and poisoned wounds, in burns and scalds, in carbuncle, and in erysipelas, in which the tissues often succumb under the resulting inflammation with amazing rapidity. Hence, such cases, of which the annexed engraving (fig. 17) affords an

Fig. 17.



Acute mortification, rapid in its progress, and attended with much swelling and moisture.

excellent illustration, are generally said to be acute; and, as the parts are always infiltrated with an abundance of fluids, the term "moist" is also often used to designate them.

II. Mortification from *mechanical obstruction* of the circulation may be caused by direct injury to the arteries, or indirectly through disease of the heart, interrupting the flow of blood to the part. The operation of tying the femoral artery for the cure of aneurism of the popliteal, is occasionally followed by mortification of the foot and leg; and the same accident sometimes happens from the pressure which a tumor of this kind exerts upon the terminal branches of this vessel. The circulation being thus impeded, inflammation, generally of a very active kind, is liable to be awakened, which soon overpowers the affected tissues. Laceration of the principal artery of a limb often results in the death of the structures which it supplies with blood. Disease of the valves of the heart, leading to vascular engorgement of the feet and legs, along with œdema of the subcutaneous cellular tissue, not unfrequently produces similar effects. Tight bandaging, pressure of the body from protracted decubitus, and inordinate constriction of the bowel, in strangulated hernia, are so many causes of mortification from interruption of the circulation.

III. The influence of *chemical agents* in producing inflammation and mortification is exemplified in various ways. The contact of the alkalies and acids, if very slight, will, in general, cause merely a rubefacient effect; if more severe, it will induce vesication; while, in its worst form, it will occasion instantaneous destruction of the tissues. The application of heat and cold acts very much in the same manner. In all these cases life is destroyed, either by the primary impression of the chemical agent, or as a consequence of the violence of the resulting inflammation. In persons of feeble organization, especially in young children impoverished by starvation and disease, the application of a common blister is often followed by extensive sloughing;

and a similar effect is occasionally witnessed as a result simply of the protracted use of a mustard plaster. The infiltration of urine in the cellular tissue of the perineum often produces wide-spread gangrene of the scrotum; and portions of peritoneum sometimes perish from the contact of bile and feces.

Although we know nothing of a definite character of the nature of animal poisons, yet it is highly probable that they induce inflammation and gangrene very much in the same way as the acids and alkalies. Some of these poisons are the product of a peculiar secretion with which the animal is provided, as a means of defence; others, on the contrary, appear to be developed in consequence of a peculiar septic action, which is particularly strong during the last moments of life, and for a short time afterwards, before the tissues have undergone much decomposition. However generated, their insertion into the living structures usually awakens a peculiar form of inflammation, which not unfrequently terminates in the death of the affected structures; often with extreme rapidity, as, for instance, in snake-bite, chancre, and malignant pustule.

IV. Defect of *nervous energy* is an occasional cause of mortification. Observation long ago showed that a palsied limb is much less capable of resisting the influence of ordinary physical agents than a sound one, and that, when inflamed, the morbid action is much more liable to terminate in mortification than under ordinary circumstances. In apoplexy and injury of the spinal cord, attended with lesion of innervation, the most trifling puncture, and even the application of a blister will sometimes be followed by the death of the part. The occurrence of bad bed sores, from the same cause, is a matter of daily observation. The division of the peroneal nerve in the removal of a tumor of the leg has been succeeded by mortification of the small toes: and Magendie ascertained, many years ago, that if the ophthalmic branch of the fifth pair of nerves be cut, the resulting inflammation will end in sloughing of the cornea.

V. The occurrence of mortification from *general debility* is well illustrated in typhoid fever, scarlatina, measles, smallpox, and scurvy, as well as in other states of the system, attended with loss of innervation, and an impoverished condition of the blood. During the progress of these diseases, local inflammation, however induced, is extremely liable to assume a bad type, and to terminate finally in mortification. In typhoid fever, extensive sloughs often form upon the hips and sacrum, despite of all the attention we can bestow upon the patient, in the way of warding off pressure; and in scarlatina, and other eruptive maladies, mortification of the neck and throat is by no means uncommon from an inflammation, which, under ordinary circumstances, would readily resolve itself in a few days, but which, now that the system is exhausted by the operation of the peculiar poisons of these affections, is promptly followed by the death of the part. Inflammation of an organ, lighted up immediately after the occurrence of profuse and debilitating hemorrhages, is very liable to eventuate in the same disastrous manner. Mercury given in low states of the system, to the induction of ptyalism, often leads to violent sloughing

of the gums and cheeks, and to necrosis of the jaw and teeth, followed by the most horrible disfigurement of the features.

In Germany, a form of mortification of the lower jaw has long been known among the operatives engaged in the manufacture of lucifer matches, in consequence of the pernicious effects of phosphorus; and within the last few years several cases of a similar nature have occurred in this country. What the mode of action of the article is in producing this result, is still a mystery. It is supposed by some that it makes its impression locally; but, if this were so, it is reasonable to presume that it would also injure the soft parts, which, however, is not the fact. We may therefore conclude, in the absence of reliable information, that it acts through the constitution, but why it should affect the lower jaw-bone, in preference to other portions of the skeleton, is not known. Possibly its operation may be similar to that of mercury.

When acute inflammation is about to terminate in mortification, there is, in general, a sudden aggravation of all the previous *symptoms*, both local and constitutional. The pain and sensibility become more keen and intolerable, the redness assumes a more vivid aspect, the swelling and tension materially increase, effusion is unusually active, and functional disorder is at its maximum. If sores or wounds exist, all discharge generally ceases. Along with these local phenomena, there is marked augmentation of the constitutional trouble; the fever is excessive, the pulse is frequent, and often quite strong, the thirst is intense, and there is great restlessness, commonly with more or less delirium. The type of the constitutional symptoms exhibits much diversity. In young and robust individuals it is generally of a sthenic character, or denotive of strength; but, when the disease has been unusually violent, or the system has sustained a serious shock, whether from the present attack, or from previous suffering, it is commonly indicative of prostration, the tongue and mouth being dry, the pulse frequent and feeble, the stomach irritable, and the surface bathed with cold perspiration.

The complete cessation of vitality is denoted by the livid, black, or mottled discoloration of the part, supposing that the mortification is external; by all absence of heat and sensibility; by a peculiar fetid, or cadaverous odor; and by more or less crepitation, in consequence of incipient decomposition. Immediately beyond the seat of the mortification the ordinary phenomena of inflammation are still visible; the surface being of a scarlet hue, hot, dry, tumid, and painful, the dead and suffering parts being usually insensibly blended or marked off by a faint, indistinct line.

The part having actually died, the general symptoms are no longer of an equivocal character, whatever they may have been during the previous struggle. They are clearly of a typhoid nature, and, consequently, fully denotive of the exhausted condition of the system. The pulse is small and feeble, and from one hundred and forty to one hundred and sixty a minute; the surface, bathed with a cold clammy sweat, has a yellowish, withered appearance, and exhales a peculiarly disagreeable odor, not unlike that of moist earth; the respiration is short, hurried, and difficult; the countenance is pale and

shrunken; the eyes are devoid of lustre and sunk in their sockets: the nose has a singularly pinched appearance; the lips are incrusted with dark scabs; the tongue is dry, contracted, and covered with a thick blackish fur; the abdomen is tympanitic; and there are frequent twitchings of the tendons, with hiccough, and low, muttering delirium. The strength is so much exhausted that the patient cannot sustain himself upon his pillow, but constantly sinks down in the bed; the stomach is harassed with nausea, and occasionally with bilious vomiting; and, towards the last, there are often involuntary discharges from the bowels, with retention of urine.

The cause of this depressed condition of the system is probably twofold. In the first place, it may be supposed to depend upon the shock which such an occurrence must necessarily inflict upon the great nervous centres; and, secondly, upon the absorption of vitiated matter, which, by its union with the blood, contaminates both solids and fluids, rendering them thereby incompetent for the discharge of their appropriate functions.

The *color* of the mortified parts varies in the different organs and tissues. The skin, as already remarked, is usually purple, black, or mottled, while the cellular tissue beneath it generally retains, in great measure, its normal complexion, unless, as sometimes happens, it has been infiltrated with bloody matter, when it will, of course, be of a reddish or modena color. The aponeuroses, muscles, tendons, nerves, vessels, cartilages, and bones undergo very little change in this respect. In mortification of the lungs, the color is black; of the brain, grayish or ashy; of the liver, reddish or yellowish. The serous membranes are commonly of a purple tint, and the mucous of a black, brownish, or claret, with almost every possible intermediate shade. As a general rule, it may be assumed that the depth of the color of the sphacelated structures is in direct ratio to their vascularity and the violence of the antecedent action.

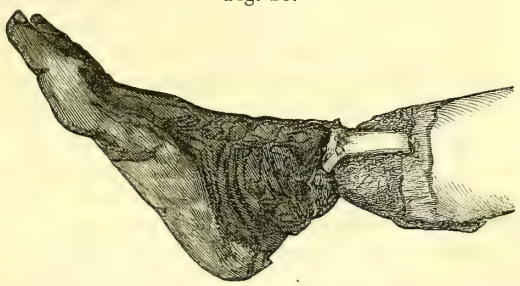
The *consistence* of the dead part is also variable; but in general it is quite soft, and, as it were, broken down, from the infiltrated condition of the cellular tissue and of the intermolecular spaces of the proper structure of the affected organ. In mortification of the limbs, involving all the component tissues, the part feels swollen, soft, and crepitant, because it contains both gas and different kinds of fluids, as serum, pus, and blood; but if we examine the individual textures, they will all be found, with the exception of the areolar, to be very nearly of their normal consistence, particularly if there be as yet but little decomposition. In the parenchymatous organs, as the brain and lungs, the loss of cohesion is always very great, the mortified mass being of a soft, pap-like consistence.

The *fetor* in mortification is peculiar and characteristic. It evidently depends upon the extrication of sulphuretted hydrogen gas, and is sometimes, as in mortification of the lungs, almost insupportable.

The *effects* of mortification upon the general system vary with many circumstances; they may be so severe as to destroy life in a few hours, or, at most, in a few days, as occasionally happens in the traumatic form of the lesion; or, on the other hand, so slight as to be hardly

felt even as a serious inconvenience. In the latter case, an attempt is generally made, after some time, to detach the dead parts from the living, by the establishment of ulcerative action, the first evidence of which is exhibited in the formation of a circle of vesicles, usually filled with a sero-sanguinolent fluid. Presently these vesicles burst, and then a faint reddish line is observable, technically called the line of demarcation, which, as it is denotive of the cessation of the gangrene, is always looked for with great anxiety by the attendant. The process, which constitutes a species of natural amputation, often proceeds with considerable rapidity, one part separating after another, generally skin and cellular tissue first, then muscle, next tendon and aponeurosis, then vessels and nerves, and, lastly, cartilage and bone; the latter being always detached with extreme difficulty, on account of the large quantity of earthy matter which it contains (fig. 18). It is owing to this circumstance that several months commonly elapse before the connection is finally severed, and then the proceeding is often anything but surgical, the stump thus made being rarely well covered with integument, a matter of so much consequence in the subsequent progress of the case, and the ultimate well-being of the patient.

Fig. 18.



Mortification of the foot and leg, with an appearance of the sloughing process, the soft parts being extensively separated from the bone.

The separation of the dead parts is always accompanied with more or less pain, discharge, and fetor, adding still farther to the prostration of the system, and the danger of constitutional contamination. The pain is sometimes excessive; at other times it is insignificant, depending upon the extent of the morbid action, and the state of the constitution. In general, it is sharp, smarting, or burning. The discharge, which is often quite profuse, is always, at first, unhealthy, ichorous, or sanguinolent, and irritating; by degrees, however, it assumes a more favorable character, and at length acquires all the properties of laudable pus. The fetor is generally most horrible, sickening, and overpowering; tainting the atmosphere of the apartment, and exerting a most prejudicial effect upon the patient, unless prompt and effectual measures are adopted for its correction. The emanation is, of course, rather from the dead parts, now called a slough, than from the gap, or trough, which lies between them and the living. As the separation progresses, granulations gradually spring up along the raw border, exhibiting the usual appearances of healthy bodies of this kind in other situations, and furnishing an abundance of thick, yellowish pus, which, while it serves to shield them from the rude contact of the air, affords the surgeon an excellent opportunity

of judging of the nature of the ulcerative action, or, in other words, of the state of the part and system.

While these changes are going on between the dead and living parts, for the riddance of the former, and the benefit of the latter, all the ordinary phenomena of inflammation are plainly visible in the structures above the breach, nature being busy in throwing up her walls of defence by pouring out a liberal supply of plastic matter into the meshes of the cellular tissue. In this way, the surviving structures are solidified and fortified against the ingress of air, and also, at least in some degree, against the absorption of pus.

The manner in which the vessels are closed during the progress of mortification, so as to prevent them from parting with their contents during the act of sloughing, is curiously interesting, and well calculated to elicit admiration. As was before stated, both the arteries and veins possess a wonderful conservative power, by which, at least in many cases, they are enabled to maintain their vitality in the midst of the dead and perishing structures. At length, however, they also yield to the devastating influence, but before this is fully accomplished their contents coagulate, and becoming firmly adherent to their inner walls, the vessels are thus, as it were, hermetically sealed. Hence, during the sloughing process it is impossible that there should be any bleeding; and for the same reason there is often no hemorrhage whatever during the artificial section of the part, inasmuch as the clots of blood frequently extend many inches beyond the line of demarcation.

Treatment.—The treatment of acute mortification is to be conducted upon the general principles applicable to that of inflammation. When this event is about to occur in a person of strong, robust habit, with a vigorous pulse, and a red, fiery, and painful condition of the part, the indication is to draw blood by venesection and leeching, to make free use of the antimonial and saline mixture, along with a sufficiency of morphia to allay pain and quiet the heart's action, and to cover the affected surface with a large blister, to paint it with iodine, or to keep it constantly wet with saturnine and anodyne lotions, either tepid or cold, as may be most agreeable. When the local action is accompanied with severe swelling, punctures, scarifications, or incisions should be made, freely and early, in order to afford vent to effused fluids, to relieve congestion, and to moderate pain and tension. The approach of gangrene may often be averted, or, at all events, materially checked, by the timely use of a blister, large enough to cover in not only the whole of the inflamed part, but also a portion of the healthy skin, and retained sufficiently long to effect thorough vesication. I am satisfied, from observation, that there is, in general, no more efficient remedy, and I therefore rarely ever omit its employment. It is particularly valuable in the idiopathic form of the disease, although it is not without its benefit in the traumatic. I was first led to use it from its great efficacy in erysipelas, where it unquestionably very frequently averts the occurrence of gangrene altogether, and it is well known to the American surgeon that it was a favorite means, in this affection, in the hands of Physick.

When mortification has actually occurred, our line of conduct must

of course be different from what it is when we are watching its approaches. The symptoms may still be of a sthenic nature, as will probably be the case when the patient is young and robust, and the part invaded is of trifling importance in the scale of organic life. Nevertheless, it would hardly be proper, even then, to indulge in farther depletion, certainly not in depletion of a general character; leeching may be admissible, and we may perhaps continue, in a moderate degree, the internal use of antiphlogistics; cautiously and warily, however, lest they be instrumental in bringing on premature exhaustion, and thus placing life in jeopardy. When, on the contrary, the patient is feeble, the pulse small and frequent, and the tongue already covered with a brownish fur, clearly denotive of an asthenic state of the system, stimulants and tonics must be employed, and, in fact, every means taken to husband the remaining powers of the constitution. The best remedies, under such circumstances, are quinine, carbonate of ammonia, camphor, and opium, alone or variously combined, together with wine-whey, pure wine, or, what is far better than either, brandy, gin, or whiskey. The diet must be as nourishing and concentrated as possible, that, while it affords the greatest amount of sustenance in the smallest space, it shall not oppress by its weight and bulk. The most suitable articles, generally, are the different animal broths, jelly, arrow-root, tapioca, and sago, which are commonly well borne by the stomach, especially if they be properly seasoned. In most cases the best treatment will be found to consist of quinine, given freely in camphor mixture; of full doses of opium, to allay pain and procure sleep; and of brandy, in the form of milk punch. Experience has taught me that little confidence is to be placed in carbonate of ammonia, musk, castor, and valerian, so much vaunted by some of the older writers, and still occasionally exhibited by modern practitioners; these articles possess no blood-generating power, and rarely do much good even as nervines. The system, in such a state, requires something more active and permanent, and if there are any means better calculated to fulfil this indication than those just pointed out, I am not aware of their existence.

Whatever measures, of a general nature, be adopted, the utmost attention must be paid to cleanliness and to the renewal of the air in the patient's apartment. Sponging the surface several times a day with tepid salt-water, or, if there be much perspiration, with a strong solution of alum, will be highly beneficial, especially if care be taken not to carry it to fatigue; the body and bedclothes must be frequently changed; and the windows must be raised several times during the twenty-four hours; for nothing is more conducive to the healthful reaction of the system, under such circumstances, than the presence of a pure atmosphere.

The object of the local treatment is to allay fetor, which is generally so excessive in acute gangrene, and to promote the separation of the sloughs in the most prompt and easy manner. The first of these measures is best accomplished by the liberal use of the chlorides, or Labarraque's disinfecting liquid, sprinkled freely upon the parts, as well as upon the body and bedclothes; and the second by the steady

application of fermenting cataplasms, or the warm water-dressing, simple or medicated. The charcoal poultice, formerly so much in vogue in such cases, is now seldom employed, on account of the manner in which it discolors and obscures the inflamed surface, thereby preventing a proper examination of its true condition. The ordinary yeast poultice is, on the whole, as eligible an application as can well be made; where an additional stimulant is required, recourse may be had to the nitric acid lotion, camphor water, pyroligneous acid, or the solution of the chlorinate of soda; pieces of lint wet with any of these substances being laid in the gap, and kept in place by the cataplasm.

When the sloughs are tardy in separating, advantage may be derived from the use of the knife, but care must be taken, in making the dissection, not to interfere with the living tissues, much less to lay open any important vessels. For want of due precaution in performing this little operation, much suffering is sometimes entailed, and I have witnessed several cases where the patient was absolutely destroyed by it; for, when the powers of life are greatly reduced by the effects of the gangrene, the most insignificant bleeding and the most trifling shock may prove fatal.

Clearance having been effected of the dead and putrid mass, the next object is to promote the granulating process, by the steady use of emollient and soothing dressings; aided, if necessary, by the nitric acid lotion, the nitrate of silver, solutions of copper, lead, or zinc, the balsam of Peru, the tincture of benzoin, and similar articles. Proper attention must also be paid to the state of the system, every effort being made to rebuild it by the judicious administration of tonics, along with nourishing food and change of air. As soon as the granulations begin to assume a healthy aspect, as indicated by their florid color, and the thick, yellowish character of the discharges, the healing process will generally progress best under the most simple dressings, serving merely as protectives against friction and rude exposure; as, simple cerate, or a light linseed poultice. If the sore be large, cicatrization may be promoted by touching its edges lightly once a day with solid nitrate of silver, and drawing them gently together with adhesive strips.

In connection with this subject the question of *amputation* necessarily arises. Under what circumstances is this operation necessary or proper? Should it be performed while the mortification is still in progress, or should it be postponed until it is completely arrested, and a line of demarcation is formed? These are important points, and they should therefore receive due consideration in every case; for it is the solemn duty of the surgeon not only to save the life, but also, if possible, the limbs of his patient. His object should ever be to preserve, and not to mutilate; for it is a thousand times more creditable to his skill and judgment to save one extremity than to lop off a hundred, however adroitly it may be done.

In attempting to settle this question special reference must be had to the nature of the mortification, or the causes under whose influence it is developed; for experience has shown that the two forms of the disease generally require different treatment. Thus, in idiopathic gan-

grene the rule now is never to amputate until the surgeon is assured, by the establishment of a circle of demarcation, that both the part and system are in a condition to bear the shock of the operation, and that death has been completely arrested. Even further delay may be demanded, if, upon careful investigation, it be found that the patient is still feeble from the effects of the mortification; that he looks pale and wan; that he has a weak and shattered pulse; in short, that everything is denotive of a broken state of his constitution. To amputate under such circumstances would greatly endanger the result, if not positively destroy the patient; proper allowance must also be made for the loss of blood and the shock which must of necessity follow the use of the knife, both of which, even when the greatest care is taken in performing the operation, are often most serious. If, on the other hand, the powers of the system are sufficiently active, if there is no apparent contamination of the fluids and solids, and, above all, if nature is making a vigorous effort to arrest the extension of the malady, there is no reason for delay, and hence the sooner the offensive parts are removed the more likely will the case be to have a favorable termination; the system is prepared for the emergency, and will soon react from any depression that may ensue from the employment of the knife. Longer delay, in truth, should not be thought of, seeing what pernicious influence the retention of the dead structures must, by their putrid and fetid condition, exercise upon the system, already weakened to an unreasonable extent by the disease before the tissues were fully deprived of vitality.

From this treatment that of traumatic gangrene is altogether different; here the extinction of vitality is usually more rapid and extensive, and hence to wait always, or even generally, for the appearance of a line of demarcation would be virtually, in many cases, to consign the patient to the grave without making an effort to rescue him from the impending danger. Where injury of an important artery, nerve, or joint is the cause of the mortification, amputation can hardly be performed too soon; nothing, certainly, can be gained by delay, which, even in a few hours, may put the case beyond our reach, such, not unfrequently, is the swiftness with which the lesion travels along the affected limb. This is particularly liable to happen in railroad, factory, and steamboat accidents, which are so common in this country, and which are often of the most frightful nature, pulpifying the soft parts, laying open large vessels and joints, and literally crushing the bones into atoms. Under such circumstances the judicious surgeon will of course amputate at once, the very moment sufficient reaction has taken place to enable the system to bear the operation; but instances often occur where the case has been neglected, or ill managed, and where death of the parts has already set in before we are consulted. Now it is precisely in such a case as this that the question will arise in regard to the propriety of immediate action, and much judgment and experience are frequently required to enable us to come to a correct decision. The proper procedure, I think, is not to hesitate, if the state of the system is such as to warrant the belief that it will be able to bear up under the shock of the operation; but I should cer-

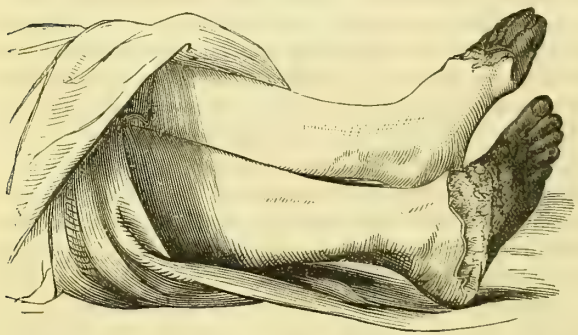
tainly refrain from it if the patient was so far exhausted as to render it probable that he would sink under it. I should, under such circumstances, endeavor to make his system rally, if possible, by the free use of cordials, as wine, brandy, and quinine, and use the knife as soon as a favorable change occurred. If this did not arise, I should prefer to let him perish from the effects of his injury rather than become his executioner.

2. CHRONIC MORTIFICATION.

There is a form of mortification, the very opposite, in many respects, to the one just described, and to which, therefore, the term chronic, or dry, may very properly be applied. The affection, which may be induced by various causes, is characterized by the remarkable tardiness of its progress, by the absence of humidity, and by the great blackness of the skin, which, when the loss of vitality is complete, looks very much like a piece of charcoal.

One of the best types of this variety of mortification is what is now generally known as senile gangrene, from the fact that it is most common in elderly subjects. It is the same disease which was so admirably portrayed, for the first time, by Percival Pott, of London, under the appellation of mortification of the "toes and feet," and which, for this reason, was formerly known by his name. It generally begins as a little bluish or purple speck, not larger, perhaps, than a mustard-seed, upon the inside of one of the small toes, which is soon succeeded by a minute vesicle, filled with a serous, ichorous, or sanguinolent fluid, and which, bursting, exposes a black surface beneath, perfectly cold and insensible (fig. 19). This spot gradually spreads in different directions until it involves the whole foot as high up, in many instances, as the ankle, or even the middle of the leg, although, in general, the patient dies long before it reaches that situation. Occasionally, the mortification begins at several toes simultaneously, or in pretty rapid succession; and I have met with several cases where it first showed itself upon the heel and instep. However this may be, the part always exhibits a characteristic appearance; it is perfectly dry and withered, cold, insensible, odorless, or nearly so, and as black as charcoal, the limb looking as if it were unnaturally small, as, in fact, it generally is. During the progress of the mortification, especially if this be somewhat rapid, the

Fig. 19.



Chronic gangrene of the feet, the disease being arrested, and the parts undergoing separation.

skin has occasionally a mottled, purplish aspect, owing to the coagulation of the blood in the superficial veins.

The disease is usually preceded and accompanied by pains in the toes and foot, darting about in different directions, and liable to nocturnal exacerbations, preventing sleep, and rapidly undermining the general health. These pains, which are of a burning, scalding, or stinging character, are often referred by the patient to the effects of gout or rheumatism, particularly if he was formerly subject to attacks of that nature; they always increase with the spread of the malady, and demand the free use of anodynes for their suppression. The dependent posture commonly aggravates them, but, in a case which I saw not long ago with Dr. Levis, of this city, the suffering was immensely increased whenever the limb was elevated even for a few moments, and where, consequently, the patient, an old man of eighty-three, was constantly obliged, during the day as well as the night, to let his foot hang down. In some instances, the attendant pain is extremely slight. Considerable swelling is sometimes present in the part, above the site of the mortification; and cases occur, although they are rare, in which the whole extremity is oppressed with œdema, being exquisitely sore, of a pale rose color, and pitting deeply under pressure.

Well-marked *constitutional symptoms* attend this complaint, usually from the very first, and sometimes even before there is any local evidence of its presence. They are either of an asthenic type from the beginning, or they soon become so. The pulse is feeble and upwards of one hundred and twenty in the minute, quick, sharp, and irritable. The tongue is coated with a brownish fur, dry, and more or less tremulous; the appetite is impaired; the bowels are costive; the alvine evacuations are fetid; the urine is scanty and high-colored; the sleep is interrupted by pain and frightful dreams; the strength rapidly declines; and the patient gradually dies from sheer exhaustion, the period between this event and the commencement of the attack varying from six weeks to three or four months.

This form of gangrene occurs in both sexes, and probably with nearly equal frequency, although it was formerly supposed to be more common in men than in women. It is observed in all classes of individuals, the rich and the poor, the idle and the industrious, the temperate and the dissipated. Nearly all the cases, probably about thirty, that have come under my notice occurred among the middle and poorer orders of the community. Mr. Pott was of opinion that the disease was peculiar to the old, but subsequent experience has shown that it may take place at different periods of life; and within the last fifteen years a number of cases have been reported where it occurred in children under ten years of age. It has been conjectured that a gouty and rheumatic temperament predisposes to the development of the affection, and there are numerous facts upon record which would seem to countenance such an idea. Again, it has been asserted that particular modes of life, as indolence and huge feeding, powerfully contribute to its production.

From the form of chronic mortification which we are now considering few patients recover. If occasionally one escapes, it only forms

an exception to the rule. In most cases, the disease proceeds steadily, or, with an occasional temporary interruption, to a fatal termination. Now and then, when the powers of life are not too much exhausted, nature makes an effort to arrest the morbid action by the formation of a line of demarcation, and, this succeeding, a kind of amputation takes place, followed, after long suffering, by recovery. The event is denoted by the establishment of ulcerative action at the limits of the dead parts, immediately above which the surface exhibits a dusky, erysipelatous blush, very different from what usually occurs in ordinary gangrene. The sloughing process is generally attended with severe pain and the most offensive smell.

The *cause* of senile mortification was not, until recently, at all understood. Mr. Cowper, the anatomist, had, it is true, advanced the idea, now become general, that it was owing to ossification of the arteries, but his researches had not been conducted upon a sufficiently extensive scale to justify the positive conclusions which modern observation has so fully established. The result of my own dissections is very decidedly in favor of this view. Ossification of the arteries, however, is merely a predisposing, and not the immediate cause of the lesion, which consists in the formation of fibrinous clots closing up the calibre of the arteries, and thus mechanically intercepting the passage of the blood. I have ascertained that the principal obstruction occasionally exists at a considerable distance from the seat of the disease. Thus, I have found the occlusion limited altogether to the femoral artery, the popliteal, or the commencement of the tibial and fibular. In most cases, however, it affects also the smaller branches. The concretions generally exist in various degrees of development, from recent coagulation of the blood to complete organization; hence, while some can be easily detached, others are firmly adherent to the sides of the vessels.

What the immediate cause of these clot formations is has not been determined. It has been alleged that it is owing to the interception of the fibrin of the blood by the roughened walls of the arteries consequent upon their calcification; but my own view is that it is due to an effusion of plastic matter, the result of chronic inflammation of the serous membrane, thereby favoring the adhesion of the blood and its conversion into clots.

A very remarkable form of chronic gangrene is sometimes produced by the inordinate use of *ergot* or *spurred rye*, the secale cornutum of botanists. The affection, which has occasionally prevailed endemically, has hitherto been observed chiefly among the inhabitants of France, Germany, and Switzerland, in certain districts of which rye bread forms a principal article of diet. When the seasons are very wet an unusual quantity of ergot is generated, and this entering largely into the composition of the flour has the effect, when used for any length of time, of giving rise to mortification in the remote parts of the body. The attention of the profession was first directed to the subject in a prominent manner in 1676, by Mons. Dodard, a French physician, and since then it has been frequently noticed by other writers. For a long time doubts were entertained respecting the power of ergot to produce

this effect, and in order to solve these Mons. Tessier, of Paris, was commissioned, many years ago, by the Royal Academy of Medicine to investigate the matter experimentally. For this purpose he selected various animals, especially pigs, ducks, and turkeys, which he fed exclusively upon ergot; he found that most of them died between the tenth and twenty-fourth day, and that distinct marks of mortification existed in the bodies of all, both externally and internally. Since the poisonous effects of this substance have become so well understood the disease has almost entirely disappeared, and in this country I am not aware that it has ever been noticed in the human subject. It is said, however, to have prevailed extensively among the horned cattle of Chester County, in this State, in 1819, and in the following year in Orange County, New York, in consequence, as was supposed, of the free use of the green grass, the *poa viridis*, the seeds of which were affected with ergot.

The manner in which ergot acts in producing this disastrous effect has not been explained. It is very singular that its virulence should explode upon those parts of the body which are most remote from the heart, as the feet and legs, and the corresponding portions of the upper extremities, along with the nose, chin, and ears. I am myself inclined to believe that the primary impression of the poison is upon the blood, rendering it abnormally stimulant and plastic; and the secondary upon the inner coat of the arteries, which, becoming inflamed, thereby intercepts the liquid, and thus leads to the formation of fibrinous clots. In a word, there is reason to believe that mechanical obstruction of the vessels is the direct and immediate cause of the gangrene, and if this idea be correct, we cannot fail to discover the closest analogy between this form of the disease and senile mortification described in a previous page. It is much to be regretted that Dodard, Noel, Bossau, Gassoud, and others, who have left such admirable descriptions of the external characters of this strange affection, should not have given us any account of its pathological anatomy.

Mortification from ergotism has been observed at all periods of life; it is usually preceded by discoloration, pain, and burning heat, which, subsiding in the course of four or five days, leave the parts cold, dry, hard, insensible, of a uniform black color, and free from fetor. It generally begins in the toes, whence it gradually extends over the foot and leg, until, in some cases, which, however, are rare, it reaches as high up as the hip. Occasionally it appears simultaneously both in the lower and upper extremities, as well as in the nose and ears. Sometimes the disease is accompanied by considerable swelling and by the most excruciating pain, which allows the patient no rest day or night. The constitutional symptoms vary, being at one time very slight, at another excessive; in general, however, the patient is tormented with fever, thirst, restlessness, and high delirium. Under favorable circumstances ulcerative action is set up, and this, gradually progressing, at length eventuates in spontaneous amputation of the sphacelated structures.

Anomalous cases of chronic mortification occasionally occur, so obscure in their character as to render it impossible to refer them to

any particular division of the disease. To this variety belongs the extraordinary instance, published a few years ago, in the Philadelphia Medical Examiner, by Dr. Bernard Henry, of this city, of a female, aged forty-two, who suffered from gangrene of all the extremities, from the effects of which she finally died. She was the mother of nine children, was of intemperate habits, and formerly affected with syphilis. The malady was preceded by stinging and burning pains in the hands and feet, which, together with the top of the nose and the skin of the knees, were gradually transformed into black, dry, and shrivelled bodies, the gangrene finally extending beyond the middle of the arms and legs. The only lesion revealed on dissection was some contraction of the left auriculo-ventricular orifice, which seemed to have obstructed the flow of blood into the aorta. The arteries were free from ossification.

This disease sometimes appears at a very early age. An instance, the particulars of which were related to me by the late Dr. Leonard, of New Albany, Indiana, occurred, some years ago, in the vicinity of that city, in a little girl only six years old, who, while seemingly in tolerably good health, was suddenly seized with excessive prostration, accompanied with delirium, unconsciousness, and great depression of the temperature of the whole body. In a short time the left lower extremity became livid, and by next morning the foot was found to be dead as high up as the ankle, the surface being black, dry, cold, and insensible. At the end of about a week a line of demarcation began to appear, and amputation being performed below the knee, the case resulted in a good recovery. It is worthy of remark that the little patient experienced at no time any considerable pain or constitutional disturbance.

Treatment.—Much diversity still exists among authors respecting the proper method of treatment in chronic mortification; some favoring stimulating measures, while others are the warm and avowed advocates of depletion, just as if it were possible in a disease which exhibits such a protean character to lay down any one plan that shall be applicable to all cases. When a writer recommends an exclusive system of treatment, and especially when he inculcates the adoption of that treatment with extraordinary enthusiasm, tinctured, perhaps, with a sense of bitterness which neither the subject nor the occasion demands, his views may well be received with some degree of allowance; and to no surgical topic is this remark more justly applicable than to that under consideration. If the reader will take the trouble to peruse the literature of the profession upon this subject from the time of Mr. Pott down to our own, he cannot fail to be struck with the truth of this remark, nor fail to lament the uncertainty of medical doctrine and practice. How are we to reconcile such discrepancies? By supposing that different practitioners have had totally different and opposite classes of cases, or that the disease varies in different countries and at different seasons, being now attended with high excitement, and now with great depression? Such occurrences are possible, but not probable, unless we conclude that there has been an extraordinary concurrence of events, or that the views of these opposite partisans are

founded upon the most limited personal experience. A more plausible conjecture is that these notions are incorrect, from having been deduced from an insufficient number of facts, or that they are the offspring of preconceived hypotheses. However this may be, it is certain that no one method of treatment is applicable to chronic gangrene, although, as a general rule, the stimulant will be found to be the most reliable. I have seen cases, where, from the robust state of the individual, and the character of the pulse, no doubt could be entertained about the propriety of the employment, at least to a moderate extent, of antiphlogistic measures, where, indeed, even the lancet and antimony were admissible; but I am quite sure that such instances are comparatively few, and that, even in them, too much caution cannot be used in their adoption. Nine patients out of ten would be injured by this course. The symptoms are generally of a typhoid character from the very beginning of the malady, and not only so, but the disease nearly always occurs in old, worn-out subjects, or in persons who have long labored under depression of the nervous, vascular, and muscular powers, and who are therefore ill prepared to undergo such a plan of treatment with impunity. Tonics and stimulants, judiciously administered, and aided by appropriate local measures, constitute the proper means in such cases. Sometimes a "masterly inactivity" is more effective than anything else, the surgeon doing little more than watching the case, and attending to his patient's diet, bowels, and secretions. But, in general, it will be found that a supporting plan of treatment is absolutely necessary, to prevent the system from falling into a hopeless state of exhaustion. Quinine, carbonate of ammonia, and the tincture of the chloride of iron, with wine-whey, or milk punch, and opium, are the articles most to be relied upon, and they should be given in such doses as shall be calculated to meet the exigencies of each particular case.

Locally the best remedies are the dilute tincture of iodine, brushed very thoroughly twice a day over the whole of the affected part, and the use of the bandage, applied with moderate force, and kept constantly wet with a strong solution of opium and acetate of lead, Goulard's extract, or hydrochlorate of ammonia. Leeches are usually objectionable, as their bites are sometimes provocative of gangrene, and the same remark is applicable to punctures and incisions. By these means the inflammation of the obstructed vessels may now and then be promptly arrested, and the further extension of the mortification prevented.

When the sloughing process has commenced, the treatment must be conducted upon the same general principles as in the acute form of the malady, only that the local applications should, if possible, be still more mild and soothing. The most eligible remedies are, according to my experience, the nitric acid lotion, in the proportion of from two to six drops to the ounce of mucilage of gum arabic, or the opiate cerate, for the ulcerated surface, and cloths constantly wet with a solution of chloride of lime for the dead, especially if there be much fetor. As the parts become detached they may be removed with the scissors, but this must be done with the greatest possible

gentleness, as the slightest injury inflicted upon the living tissues is sure to be productive of mischief.

In regard to the question of amputation, it is extremely difficult to give any satisfactory statement. My belief, founded upon considerable experience, is that we ought scrupulously to follow the practice long ago laid down by surgeons not to interfere until there is a well-marked line of demarcation; and indeed, not even then unless it is perfectly evident that there is sufficient strength of the system to bear the shock of the operation. I have, however, seen several cases where amputation was succeeded by the most happy results before nature had made any attempt to cast off the slough, and that too under circumstances apparently not at all promising as it respected the powers of the constitution. Whenever surgical interference is deemed advisable no means should be spared to support the patient with tonics and stimulants, as upon their judicious use the chances of his recovery will, in great degree, depend. When the operation is performed prematurely, or before the system has sufficiently recovered from the exhausted condition consequent upon the gangrenous action, the disease will generally reappear within a few days after upon the stump, or death will follow from sheer prostration.

In regard to chronic mortification from the use of ergot, we have no positive knowledge to guide us in our treatment. There is no remedy, so far as is at present known, the employment of which exerts the slightest counteracting influence upon the deleterious effects of this substance upon the system. Hence the only proper plan of procedure is to treat all such cases upon the general principles just laid down in respect to the management of the ordinary form of chronic gangrene.

SECT. VII.—HOSPITAL GANGRENE.

Under this name may be described a variety of mortification, or of mortification and ulceration, which often commits great ravages among the wounded in crowded hospitals, in camps and on board of vessels of war. The disease appears to be much more common in Europe and in the East than in this country, where, judging from the silence of the profession respecting it, it is exceedingly infrequent, a case being rarely met with even in our larger eleemosynary institutions, while in private practice it is almost unheard of. I place this affection between mortification and ulceration, as it evidently, in many cases, if not in all, strongly partakes of the nature of both.

Although it is extremely probable that hospital gangrene has existed from time immemorial, yet no distinct and satisfactory account of it appeared until 1783, when an admirable description of it was published in the posthumous works of Pouteau, of Lyons, who had himself suffered from a severe attack of it while resident pupil of the Hôtel Dieu of that city. Soon afterwards attention was directed to it by Dussassoy, whose treatise was rapidly followed by the tracts of Moreau, Burdin, Gillespie, Leslie, Blackadder, Brauer, and Boggie, to whose joint labors

we are mainly indebted for our present knowledge of this curious disease.

Various names, more or less expressive of the nature of this disease, have been employed to designate it by different authors. Thus, by Pouteau and some of the earlier writers upon the subject, it was denominated hospital gangrene, evidently in reference to the frequency of its occurrence in this class of public institutions, of which it was at one time the great scourge, both in military and civil practice, particularly the former. Subsequently it was described under the appellations of contagious gangrene, gangrenous phagedena, putrid degene ration, malignant, sloughing, or putrid ulcer, camp gangrene, and humid hospital gangrene.

Sporadic cases of this variety of gangrene, more or less severe, are occasionally met with in all large hospitals and other places crowded with sick and wounded, but we no longer hear of that frightful devastation which used to characterize its existence in former times. This happy change is no doubt due to the great attention which the modern practitioner bestows upon ventilation and cleanliness, and the prompt segregation of his patients on the appearance of the malady. According to Mr. Macleod, hospital gangrene was not at all common during the late war in the Crimea; it prevailed during the first winter in a mild form at Scutari, but it never became either general or severe, although the barrack hospital of that city was, during the early occupation of the troops, in a very filthy and uncomfortable condition. Whenever any cases broke out, the patients were at once isolated, and sent into wards especially set apart for the treatment of the disease.

Formerly hospital gangrene often prevailed as an *endemic*, attacking almost every one that was brought within its baneful influence, and thus causing the most horrible mortality. In the Hôtel Dieu, at Lyons, in the time of Pouteau, several frightful outbreaks of this sort appeared, and such were their ravages that this distinguished surgeon was induced to ask the question, whether hospitals were not an evil instead of a blessing. In 1780, the disease prevailed extensively among the inmates of the naval hospital at New York, some of whom had been sent thither from the American squadron, then in port on account of stress of weather, others from the West Indies. Upwards of two hundred cases occurred, and of these many died; quite a number from the recurrence of gangrene upon the stump after they had suffered amputation. In 1781, the malady committed terrible ravages at the naval hospital on Pigeon Island, St. Lucia. In 1800, it prevailed extensively on board the Prince of Wales, on her homeward passage from Martinique to England; the suffering is described as having been excessive, and it is stated that every little scratch or injury, in whatever manner inflicted, speedily degenerated into a bad gangrenous ulcer. A short time before this, the disease existed, in a very severe form, at the Cape of Good Hope. At the hospital at Bilbao, after the battle of Vittoria, the mortality from this source was excessive. In the Parisian hospitals, the disease has prevailed, off and on, for many years, often sadly interfering with the results of surgical accidents and operations. In 1847, it appeared in some of the London

hospitals, and nearly at the same time in some of those at Edinburgh; in both cities, however, in a mild and transient manner.

I have adduced these references with a view of showing the occasional epidemic tendency of this disease, and the consequent absolute importance of avoiding the huddling and crowding together indescriminately of the sick and wounded in large hospitals, camps, and other places, often selected with little judgment, for the accommodation of the poor. There can be no doubt whatever that much, if not the whole, of the immunity enjoyed by the hospitals, infirmaries, and almshouses of this country is due to the vigilance that is exercised in the sequestration of their inmates and the great attention that is paid to the cleanliness and ventilation of these establishments; circumstances which can never fail to exercise a powerful prophylactic influence upon this and other diseases whose origin and propagation are so closely connected with a vitiated state of the atmosphere and a disordered condition of the blood.

Hospital gangrene shows itself in one of two ways; either as an original affection, upon an unbroken surface, or in connection with an open wound, ulcer, or abrasion; more frequently in the latter than in the former. When the tendency to the disease is very strong, the slightest scratch, or the most trivial sore or wound may become the means of propagating it, and of producing the most frightful ravages. Several instances have been recorded of the most horrible sloughing occasioned by the accidental inoculation of the bite of the mosquito. When the disease prevails endemically, or even when there is merely some tendency to its outbreak, no operation, however insignificant, can be performed with any certainty that it will not be followed by hospital gangrene. The stripes inflicted in flogging soldiers have frequently been known to become the seat of the disease in its very worst forms. Boils, abscesses, sinuses, and fistules generally, under such circumstances, share a similar fate. It has been noticed, what is certainly very singular, that when hospital gangrene exists as an endemic, it manifests but little disposition to seize upon ulcers of a specific nature, as chancres, syphilitic buboes, and cancerous sores. In its sporadic form, on the contrary, these are the parts which seem to be particularly liable to suffer; the disease often attacking them, apparently, in preference to the simple ulcers that may happen to be upon the body at the time of its invasion.

The distinction, which has been made by some authorities, of this disease into sloughing and phagedenic, seems to me to be without any foundation in truth, since it is evident that the two affections are merely different grades of the same disorder, the one destroying the tissues in large masses, the other on a small scale, the action by which this is done being strictly identical in both cases. A much more important division is that into idiopathic and traumatic, the origin of the former depending upon constitutional causes, that of the latter upon external injury.

If we inquire into the *causes* of this variety of gangrene, we shall find nothing of a very satisfactory nature to reward our labor. While some regard it as a strictly local affection, others are disposed to con-

sider it as having a constitutional origin; and in this opinion I am strongly inclined to concur, from a careful study of the history of the disease, both from what I have seen of it myself, and from the accounts that have been given of it by different writers. Possessing many features in common with erysipelas, it is highly probable that, like that disease, it owes its origin to a species of blood-poisoning, depending upon a foul, infected atmosphere, operating upon a depraved and enfeebled constitution. It is very certain that the strong and robust are much less liable to suffer from it than those of an opposite state of the system, or who have become exhausted by intemperance, disease, exposure, or want of proper food; and it is often easy to determine beforehand, when a great many persons are crowded together in the wards of an infected hospital, which will be likely to be attacked and which to escape, simply from the differences in their appearances. Whether the subjects of hospital gangrene are capable of generating a poison which, in its turn, can impart the disease to others, by its operation upon the system, is a point for whose solution we possess no reliable data; but that this is the case, seems to be extremely probable. However this may be, the fact that the malady may be communicated by actual contact of the secretions of a gangrenous sore with a sore of a healthy character, seems to be well established; at all events, the theory is constantly acted upon in institutions where the disease is prevalent, in the care which is taken to prevent sponges and other articles used in cleansing and dressing affected persons, from being employed upon healthy ones. A very striking circumstance, bearing strongly upon the question of the existence of a distinct poison elaborated during the progress of this malady, has been recorded by Sir George Ballingall, in his Outlines of Military Surgery. Referring to this disease as it prevailed in a regimental hospital at Feversham, in 1806, he states that, after the endemic had been going on for some time, it was discovered that all the ulcers in the establishment had been washed with one sponge. A different mode of cleansing the sores was immediately adopted, and the consequence was that not a single case of the disease appeared afterwards. When to this circumstance is added the result of the experiment of Ollivier, who produced the disease in his own person, by inserting matter, taken from an ulcer of the very worst description, into the arm just below the attachment of the deltoid muscle, it is impossible to withhold our belief in the contagious property of traumatic hospital gangrene. The case of Blackadder, who suffered severely from a puncture accidentally inflicted upon one of his fingers in dissecting the stump of a man dead of this affection, is equally strong and convincing.

A scorbutic state of the system, severe shock, loss of blood, and, in short, all depressing influences whatever, probably act as so many predisposing causes of this disease, by lowering the powers of the heart and nervous system, and thereby favoring the operation of the septic poison, if such a poison really exist. Protracted courses of mercury, or exposure to wet and cold during salivation, have often been observed to be followed by the disease during its endemic

prevalence. In private as well as in hospital practice, it is particularly liable to be induced in young, unhealthy, scrofulous persons, affected with syphilitic ulcers, and weakened by all kinds of privation, especially the effects of cold, and the excessive use of ardent spirits. In the army and naval service of Europe, it formerly often supervened upon severe and exhausting attacks of dysentery, scurvy, and typhoid fever.

The time that the poison of hospital gangrene lies *latent* in the system has not been determined. It probably varies in different persons and in different cases, depending upon the previous state of the general health, and the peculiar mode of the infection. In most cases it is short, not exceeding thirty-six or forty-eight hours before it shows its specific effect. When the infection is indirect, a longer time is probably required for the development of the disease than when it is direct, or effected by actual contact of the secretions.

The disease occurs at all periods of life, and the only reason, probably, why children do not suffer more frequently, is that they are so seldom subjected to the influence of its exciting causes. Both sexes are obnoxious to it; but, for the reason just mentioned, men suffer much oftener than women. No season of the year is exempt from its attacks, but observation has shown that it is most common, as well as most virulent, in hot weather.

The *symptoms* which characterize this affection are partly of a local, partly of a constitutional nature, the order of their priority being not always easily determined. When it supervenes upon an ulcer or abrasion, the appearance of the pre-existing affection undergoes at once a series of the most important changes, completely modifying its whole aspect. The discharge is sensibly diminished, or, perhaps, entirely dried up; the granulations, if any exist, assume a dark, foul appearance, and are rapidly destroyed; a large quantity of aplastic lymph, of a dirty grayish color, soon covers the bottom of the sore, the edges of which at the same time become jagged and everted; the adjacent parts are of a deep purple or livid hue, and the seat of numerous vesicles, filled with a sanious or bloody serum; the pain is constant and excessive, being sharp, biting, or stinging; the affected structures exhale a horrible odor; and swelling is both great and threatening. Sloughing now takes place, skin, cellular tissue, fascia, and muscle often dropping off in large, livid, putrescent masses, thoroughly impregnated with the most horribly offensive secretions. In the more severe forms of the lesion, the ravages are not limited to the soft parts, but often extend to the bones and even to the joints; the affection, perhaps, rapidly travelling up a limb until it is completely destroyed, the patient literally dying, as it were, by inches. Long before this crisis has been attained, indeed, generally at an early period, glandular swellings are observed in the groin or axilla, possessing many of the features of pestilential buboes; they usually involve a number of ganglions, and are always exquisitely tender and painful, thus greatly aggravating the local and constitutional distress. When suppuration occurs, which, however, is not invariably the case,

the discharge is generally abundant and highly fetid, and the resulting ulcer speedily exhibits all the characteristics of the parent sore.

When the disease appears on an unbroken surface, which, however, it rarely does, its advent is announced by the formation of one or more little vesicles, or blebs, filled with ichorous fluid, and surrounded by a reddish areola; both gradually extending, the former soon bursts, and thus reveals a dirty, foul slough, which, dropping off, exposes a filthy looking, excavated cavity, incrusted with a thick layer of adherent, grayish, unorganizable lymph. The parts feel hot and stinging; there is great swelling, with livid discoloration, of the adjacent surface, and a tendency to rapid extension and destruction, the different tissues dying either together or successively, in the same manner as when the disease is ingrafted upon an ulcer or open sore.

The constitutional symptoms of hospital gangrene are generally well marked, their severity being usually in proportion to the violence of the local disturbance. If the patient, prior to the attack, was tolerably strong and robust, they will probably be of a strictly inflammatory nature, but in any event they will soon lose this type, and assume the asthenic form, which will become more and more distinct as the disease pursues its downward tendency. The pulse will be found to be unusually frequent, quick, and irritable; the mind is peevish, fretful, and desponding; the tongue is dry, and covered with a brownish fur; the strength is much impaired; and the pain is so excessive that the patient is completely deprived both of appetite and sleep. Delirium often sets in at an early period, forming one of the most prominent symptoms.

The *diagnosis* of hospital gangrene is generally not difficult, for there are few diseases with which it can be confounded. Almost the only affection, indeed, for which it is in danger of being mistaken is scurvy, but a little attention will usually serve to render the distinction between them very evident. The scorbutic ulcer, as it has been named by Lynd and other writers, is remarkable for its fungous, livid, bloody, and fetid character; the granulations are of enormous size, very soft and spongy, growing with great rapidity, and bleeding copiously upon the slightest touch. The discharge is profuse, and the blood often lies in cakes upon the surface of the sore, from which it is wiped with difficulty; the pain is trivial, and if the granulations are cut away they are speedily reproduced, generally in the course of a single night. Ulcers of this kind are nearly always attended by serious disease of the gums, which are fungous, and extremely vascular, and by hemorrhagic spots in different regions of the body. There is also, as another striking diagnostic circumstance, an absence of fever, and, generally, also of vesication. In hospital gangrene, on the contrary, there is always grave constitutional disorder, and the local phenomena are such as denote the existence of high vascular action. The ulcer is foul, exquisitely painful, deeply incrusted with lymph, and surrounded by a livid, vesicated surface. The granulating process is speedily arrested, and sloughing extends in every direction.

The *prognosis* of this disease varies with many circumstances, a few only of which it will be necessary to specify. Thus, it is always,

other things being equal, more unfavorable when the attack is of an epidemic character than when it is sporadic, and in persons who have been exhausted by previous suffering, privation, or intemperance, than in such as are young and robust. The extent of the disease must also necessarily exert a material influence upon the progress of the case, the danger being less when this is slight than when it is considerable, and conversely. Serious involvement of the brain, the early occurrence of delirium, or the development of secondary disease in some internal organ, as the lung or liver, always portends evil, and should induce a guarded prognosis. Formerly, hospital gangrene was an extremely fatal disease, the mortality being often in the proportion of one to three of those attacked. In some instances, indeed, nearly one-half perished. Since the pathology of the disorder, however, has come to be better understood, very few cases are found to prove fatal.

Death may be caused by mere exhaustion of the vital powers, in consequence of the extreme violence of the morbid action; or from the occurrence of repeated hemorrhages, as when an important vessel is laid open during the sloughing process. In general, the arteries and veins are among the last structures that yield to the devastating influence of the disease, and it seldom happens that they are not protected by a provisional clot; now and then, however, this is not the case, and under such circumstances the hemorrhage is sometimes not only profuse but fatal. Finally, there is a class of cases, by no means an uncommon one, in which, although the suffering is very great, death is apparently occasioned by an empoisoned state of the system, induced by purulent infection, or the formation of secondary abscesses. The time at which death occurs varies from a few days to several weeks from the commencement of the attack.

Treatment.—The treatment of hospital gangrene was, until lately, but little understood, and the consequence was that an immense number of persons were lost by it. The indiscriminate use of bark and other stimulants, so much in vogue among the army and naval surgeons of Europe, especially those of Great Britain, even down to the time of the late Mr. Hennen and his colleagues in the Peninsular wars, exercised, there is reason to believe, a most destructive influence upon the subjects of this disease. No judgment seems to have been employed by these practitioners in adapting their remedies to the exigencies of their cases; all were treated alike, and the result was an amount of mortality that was often truly appalling. Dr. Boggie did much to reform this vicious system, by substituting the use of the lancet; but it is questionable whether he did not err by carrying his measures to the opposite extreme. However this may be, it is certain that neither plan is applicable to all cases; but that the management of each one must depend, so to speak, upon its own contingencies. The abstraction of blood can, as a general rule, be required only in persons of a comparatively robust constitution, and in the earlier stages of the disease; but even then it should be practised with much caution, lest it should lead to fatal exhaustion, or so far damage the system as to prevent it from shaking off, without great difficulty, the morbific influence. The disease, it must be recollected,

has an asthenic tendency, often from the very start, especially when it is of an endemic character; and hence any measures calculated to favor this tendency must necessarily exercise a pernicious influence.

Purging and attention to the diet and secretions constitute important elements in the treatment, and must on no account be neglected. A good dose of calomel and rhubarb, or of equal parts of blue mass, jalap, and compound extract of colocynth, given so as to induce two or three large, consistent, alvine evacuations, will often be more beneficial in arresting the morbid action than almost everything else of which we have any knowledge. Subsequently the bowels should be constantly maintained in a soluble condition, without establishing any decided drain upon them, and the utmost care should be taken to restore the secretions, which are always so much disordered in hospital gangrene. Mercury, as a salivant, is to be avoided as a poison.

When the system begins to flag, whether from the overwhelming influence of the attack, or from neglect of the proper treatment, prompt recourse must be had to quinine, iron, wine, brandy, and nutritious broths. The best preparation of iron is the tincture of the chloride, given in doses of from fifteen to twenty-five drops, every three or four hours, in some mucilaginous fluid. Quinine is often extremely serviceable, and there are few cases, when this stage has been attained, which will not be immensely benefited by brandy, or some other form of alcohol, either alone or combined with milk.

But the great constitutional remedy in hospital gangrene is opium, either in substance, or in the form of the salts of morphia. It should be given in large doses, generally not less than from four to six grains, every four, six, or eight hours, in union with a diaphoretic, as ipecacuanha, tartar emetic, or the neutral mixture. When we reflect upon the excessive pain, irritability, and sleeplessness which so generally attend the severer grades of this disease, it is impossible to place too high an estimate upon the value of anodynes as means not only of insuring comfort to the patient, but of arresting the morbid action.

The diet, especially in the latter stages of the disease, should be highly nutritious, and given in as concentrated a form as possible. The patient's apartment should be constantly ventilated, the bed and body clothes should be daily changed, and the surface should be frequently sponged with tepid salt water, or weak alkaline solutions. Free use should be made of the chlorides, sprinkled about the room. If the disease manifests an endemic tendency, as when it breaks out on board ship, or in the crowded wards of a hospital, the patients should be promptly sequestered, and the apartments whitewashed and thoroughly cleansed.

The *local treatment* should be of the most gentle and soothing character. Any vesicles that may exist should be promptly opened, and the whole surface pencilled over with a weak solution of iodine, followed by the warm or cold water-dressing, containing a large supply of acetate of lead and opium, a cloth dipped in the solution being kept constantly upon the part. If an eschar has formed, the adjacent structures should be freely rubbed with the solid nitrate of silver, and as soon as the slough has dropped off, the bottom of the sore should be

thoroughly touched with a solution of acid nitrate mercury, with a view of changing its action. If the tendency to spread is very great, and if there is, at the same time, excessive pain with a feeling of tension, scarifications and incisions must be practised, in the same manner and with the same object as in erysipelas. During the sloughing process a port wine poultice, the weak nitric acid lotion, and the liquid chlorinate of soda will often be found extremely valuable in arresting morbid action, and allaying fetor. Dead structure should be removed with the knife and scissors. Should the mortification stop, amputation must not be thought of until there is a decided line of demarcation, with sufficient power in the constitution to bear the shock of the operation. During convalescence change of air generally proves an important auxiliary to recovery.

SECT. VIII.—ULCERATION AND ULCERS.

Ulceration is the molecular death of a part, as mortification is the destruction of a part upon a large scale; in a word, it is dissolution in miniature. At least three distinct acts are concerned in its production; these are, first, the softening of the affected tissues, secondly, their disintegration, and, lastly, their removal, as effete and extraneous matter. Antecedently, however, to these acts there is another in operation, paving the way for their advent; and this is inflammation, which is always an indispensable accompaniment of the process, whatever may be its situation, stage, or degree. It was supposed until lately, chiefly in consequence of the influence of the writings of Mr. John Hunter, that ulceration consisted essentially in the disintegration and absorption of the suffering textures; and hence the general use of the phrase "ulcerative absorption." According to this doctrine the substance of the affected part, after having been deprived of vitality, is taken up by the absorbent vessels, and carried by them into the circulating mass, to go the rounds of the body, and be finally cast off as excrementitious matter. There are numerous circumstances which, at first sight, would seem to favor such a view. Thus, large ulcers sometimes form in a very short time, and yet it is quite impossible, so far as we can determine by the most careful examination, to ascertain what has become of the tissues concerned in their development. If search be made for them in the discharges they cannot be discovered, since their quantity, however great, is frequently insufficient to account for the loss of solid substance. Similar phenomena are witnessed in abscesses of the brain, liver, and spleen, where enormous destruction of the proper structure of these organs often occurs in consequence of the accumulating pus, without our being able to explain what has become of it. We might naturally suppose that the lost tissues were contained, in an altered and disintegrated condition, in the pus, but that this is not the case, is proved by the fact that it is impossible to detect their presence by the most careful examination.

Ulceration manifests a remarkable proneness to invade some structures and to avoid others. Those which are most liable to its inroads

are the dermoid and mucous tissues, the cartilages and bones, the lymphatic ganglions, the tonsils, uterus, lungs, and kidneys. The fibrous and serous membranes, the muscles, tendons, vessels, nerves, brain, heart, liver, and spleen, together with the salivary, prostate, and thyroid glands, seldom suffer in this way. Newly-formed parts, as cicatrices and the callus of broken bones, are easily affected by ulceration, especially when, from any cause, there is a depraved and impoverished condition of the system. It is worthy of remark, both in a pathological and practical sense, that this action is more prone to show itself in certain portions of the same structure than in others. We have an illustration of this occurrence both in the skin and in the mucous membranes. Common ulceration of the skin is by far most frequent in the legs and feet, whether because these parts are in a state of habitual congestion, or because they are more exposed to fatigue and accident, I know not; but that such is the fact daily observation abundantly attests. Ulceration is extremely rare in the œsophagus, but quite common in the pharynx, tonsils, tongue, cheeks, and lips. The same statement is true of ulceration of the stomach and small intestine as compared with ulceration of the colon and rectum. In the genito-urinary division of the mucous system the same law obtains. Thus, the disease is extremely infrequent in the urethra and bladder of the female, but common enough in the vulva, vagina, and uterus. The male, on the contrary, rarely suffers in any portion of the genito-urinary apparatus.

The terms common and specific, as applied to this disease, are sufficiently significant. By the former is meant an ulceration that is liable to occur in all persons, as well as in all parts of the body; one which is the result of ordinary inflammation. The word specific, on the other hand, is employed to denote an ulceration which is the product of some specific cause, which runs a peculiar course, and which, in its progress, furnishes a specific secretion, capable, by inoculation, of producing a similar action. To this category belong syphilitic ulceration and the ulceration which follows vaccination and smallpox. The ulceration which attends carcinoma is also specific, but the matter it yields is not, so far as we know, capable of propagating a similar disease.

Ulceration varies in its progress, being sometimes very rapid, at other times very tardy. The circumstances which determine this result are not always appreciable, but, in general, they may be considered as depending upon the nature of the exciting cause, the amount of the attending inflammation, and, above all, upon the state of the system. When the action is very rapid, an extent of surface may be destroyed in a few days which it will perhaps require several months to repair. The process often goes on simultaneously at several points in the same organ or tissue, and not unfrequently in structures of an entirely opposite character.

The *causes* of ulceration are such as produce inflammation, which, as has been already stated, always accompanies the process. They may be very properly divided into predisposing and exciting. The former comprise an impoverished state of the blood, however induced,

and, in short, whatever has a tendency to impair the powers of the system. Experiments, performed long ago, by Magendie and others, have established the fact that the protracted and exclusive use of starch, sugar, and other non-azotized articles of food, will produce ulceration of the cornea; and it is well known that the poorer classes of people, who are ill fed and sometimes almost starved, are peculiarly subject to this disease in the skin and mucous membranes. Ulceration of a severe nature often follows upon various kinds of fever, especially typhoid, scarlet, and morbillous, from the exhausting influence which they exert upon the solids and fluids.

Of the exciting causes of ulceration, nothing need be said, except that they may be common or specific, the latter being such as act primarily upon a particular part, as the head of the penis in chancre, or secondarily, in the same disease, upon the constitution, in consequence of the absorption of the specific poison. Tubercular, scirrhous, encephaloid, and melanotic matter, having undergone a process of softening, always creates ulceration by its pressure upon the adjacent tissues, thereby favoring its elimination from the part and system.

The inflammation which precedes and accompanies ulceration varies much in its degree, as well as in its character. When acute, it is usually marked by the phenomena which ordinarily distinguish it under other circumstances, as discoloration, heat, swelling, pain, and disordered function, and then often spreads with great rapidity, laying waste a large amount of tissue in an almost incredibly short time. When this is the case, the molecular structures perish, as it were, in mass, and not in the slow and gradual manner which characterizes the disease when the inflammation is of a more mild and simple grade. It is to this form of ulceration that the term *phagedenic* is commonly applied, from a Greek compound which literally signifies to eat, feed upon, or corrode, the parts around the breach made by the morbid action being rapidly disintegrated and cast off, as if they had been consumed by fire, their ashes alone being left as the evidence of their former existence. When the concomitant inflammation is chronic, the ulceration generally advances more tardily, and is also marked by milder symptoms; this rule, however, has many exceptions.

The pain of ulceration is sometimes peculiar, affording thus valuable diagnostic information. Thus, in ulceration of the joints and bones, it is usually heavy and aching, as if insects were feeding upon the part; in rupia, it is hot and burning; in scirrhus, sharp and lancinating, as if needles were thrust into the parts. Sometimes, again, there is a complete absence of pain, as in common ulceration of the skin, in ulceration of the glands of Peyer in typhoid fever, and in ulceration in tubercular disease of the large bowel. As a general rule, it may be stated that the pain is more severe in the acute than in the chronic form of the disease, and, under such circumstances, it is also more steady and persistent. In syphilitic ulceration of the bones and skin, the suffering is often of an intermittent character, the paroxysm usually coming on at night, and gradually disappearing towards morning. Finally, the pain may be of a neuralgic character, although this is rare.

Ulceration is always attended with more or less discharge of matter, the quantity of which is greatly influenced by the nature of the case. Thus, when the attendant inflammation is unusually high, the matter is generally of a sanious, bloody, or ichorous character, corrosive and profuse; a similar secretion is always present in ulceration of carcinomatous growths. When the action is less severe, or tending to restoration, the discharge is commonly somewhat consistent and of a yellowish color, like laudable pus.

The tendency in ulceration is usually towards the nearest surface, and, in this way, it is often of great service in the evacuation of abscesses and the discharge of foreign matter. It would seem as if nature availed herself of the operation of this law to economize time, to save structure, and prevent pain. Without its aid, abscesses would often, if, indeed, not generally, be emptied in the most tedious and circuitous manner, and at the expense of a vast amount of suffering, both local and constitutional. An illustration of the beneficial effects of this law is afforded in collections of pus in the liver, which, as a general rule, discharge themselves, not through the walls of the abdomen, which would be both tardy and painful, but through a contiguous coil of intestine, which is both thin and proximal. In abscess of the lung, the matter usually escapes through a neighboring bronchial tube; when it makes an effort to empty itself externally, it either pours the fluid into the pleuritic cavity, thus speedily causing fatal inflammation, or it attains its object only after a long and tedious process of ulceration, generally accompanied by great pain and hectic irritation.

When ulceration has continued for some time, it manifests a disposition either to remain stationary, to stop altogether, or to continue in a modified form. Its conduct, in these various particulars, is greatly influenced by internal and external circumstances, as the state of the constitution, the amount of the local inflammation, the nature of the exciting cause, and the effects of remedies. In the skin of the lower extremities, in syphilitic rupia, in the spongy structure of the bones, in the movable joints, and in malignant growths, it often continues for an almost indefinite period, being better at one time and worse at another. When it is about to cease, the accompanying inflammation gradually subsides, the discharges disappear, and, plastic matter being poured out, granulations are formed, by which the resulting breach is finally closed up, the process of cicatrization always proceeding from the centre towards the circumference.

In the treatment of ulceration, the great and leading indication is to combat the concomitant inflammation, and thus place the part in a condition for the efficient development of granulations, as it is through their agency that the lost substance is to be repaired. For this purpose the ordinary antiphlogistic appliances are to be put in requisition and continued until the morbid action has been completely arrested, as will be denoted by the subsidence of the pain, heat, swelling, and redness by which it is usually characterized. When granulations begin to form, none but the most mild and soothing measures must be employed, and the sore carefully watched to keep it in a healthy

condition until it is perfectly cicatrized. In specific disease, as chancre and malignant pustule, the most efficient treatment, provided the case can be seen in time, before the matter has been absorbed into the system, is to cut out the part or destroy it with the actual cautery or the acid nitrate of mercury.

ULCERS.

An ulcer is a breach in the continuity of a surface, organ, or tissue, attended with inflammation, and a discharge of pus, ichor, or sanies. The disease is of frequent occurrence, being met with at all periods of life, in both sexes, and in all classes of persons, and is often a source of great suffering to the patient, as well as of immense trouble and vexation to the surgeon. Its very name carries with it an idea of loathsomeness, and it may well be imagined how much this feeling is increased when, as so often happens, the sore is the seat of foul and offensive discharges, rendering the patient disagreeable both to himself and to all around him.

It may confidently be asserted that there is not, in all surgery, a class of maladies whose pathology and treatment are less thoroughly understood, by the profession generally, than those of ulcers. It is amazing to find what an immense amount of confusion still exists upon the subject, at the present day, among many of the best and most experienced authors. In examining the various treatises on surgery, in the principal languages of Europe, the inquirer after truth has but little cause to congratulate himself upon the progress that has been effected in this department of the healing art. He looks almost in vain for any positive additions to his stock of knowledge since the latter part of the last century, when Mr. Benjamin Bell published his Treatise on the Theory and Management of Ulcers. The minute divisions and subdivisions, the refinements and absurdities, respecting the nature of these lesions, are, with little variation, substantially reproduced by most of the practical writers of the present day. In studying the literature upon the subject, one is almost forced to the conclusion that, while every other branch of surgery has experienced the benign influence of progress, this one alone has remained unimproved and uncared-for. I am, indeed, ready to admit that the nosography of ulcers is much more perfect now than it was in former times; but who can read their classification, as it appears in most of our modern treatises, and not be struck with its many absurdities and inconsistencies? The catalogue is absolutely appalling, and it must be apparent to the most superficial observer that it comprehends, under different names, diseases which are absolutely and positively identical in their nature; not even constituting, strictly speaking, so many varieties, much less distinct species. Sir Astley Cooper, in his Lectures on the Principles and Practice of Surgery, describes not less than ten forms of ulcers, under the names, respectively, of healthy, languid, inflamed, gangrenous, irritable, sinuous, menstrual, varicose, ungual, and cutaneous, the latter including *noli me tangere*, and ulcers with thickened, inverted, and everted edges. A more recent foreign author, whose

works are extensively circulated in this country, adopts a somewhat similar arrangement. Thus, he treats, under so many separate heads, of the simple purulent or healthy, the weak, scrofulous, cachectic, indolent, irritable, inflamed, sloughing, phagedenic, and sloughing-phagedenic ulcer. The same spirit of classification pervades the works of other writers. Why, then, should it be deemed strange that the student should take up the investigation of the subject with doubt and misgiving as to his ability to comprehend it, even in the most superficial manner? No one, however industrious and zealous, can possibly unravel the mysteries of divisions so minute, and, it may be added, so utterly meaningless and unphilosophical. It would puzzle the most profound pathological anatomist to discriminate between some of these classes of ulcers, as, for instance, between the irritable and inflamed, the sloughing and sloughing-phagedenic. To describe every sore that appears upon the body as a distinct ulcer because it happens to possess slight shades of differences, in its external characters, would be as absurd as to describe, in a work on anthropology, every human being as a separate variety of the race because he happens to be a little unlike his neighbor. All inflammatory affections resemble each other, some closely, others remotely, but yet always sufficiently so to enable the observer to trace out their relations and affinities. The same is strictly true of ulcers; we never meet with two cases which are precisely alike, and yet he who runs may see that they exhibit many traits in common, the one with the other; one may be undermined, incrusted with aplastic matter, and the seat of severe pain, with a foul, sanious discharge, and great discoloration, heat, and swelling of the surrounding integuments; another may have hard and elevated edges, and a glossy, granulated surface, with, perhaps, scarcely any secretion at all, and none of the ordinary evidences of inflammation; in a third case the ulcer may be disposed to spread, its tendency being essentially destructive; in another series, by no means uncommon, the sore has thickened and everted edges, with profuse ichorous discharge, and an inability to furnish reparative material; finally, there may be a varicose state of the veins of the part, a sinus, disease of the adjacent bone, or disorder of the general system, modifying the action of the ulcer, and interfering with its cure. These are, be sure, contrarieties, but contrarieties which are solely dependent upon local and constitutional causes, and which, consequently, are not entitled to be considered as distinct diseases. We might as well say that the varieties of color in ordinary inflammation constituted so many reasons for founding new species of morbid action; when it is obvious that in this as in the former case, the circumstance is entirely of an accidental character. The tendency of this refinement, of this division and subdivision, is, as above stated, the cause why practitioners have so imperfect a knowledge of ulcers, and why every one complains of the great difficulties and embarrassments which still environ the subject in all its aspects and relations, notwithstanding the great advances of pathological science.

Assuming that all ulcers are but so many forms of inflammation with breach of texture and more or less discharge, the most rational classifi-

cation, it seems to me, that can be adopted, is that of ulcers into acute and chronic, according to the intensity and rapidity of the morbid action. Such an arrangement will, I am satisfied, greatly simplify the subject and divest it of much of the mystery and perplexity that has hitherto enshrouded it.

There are two genera of ulcers, the common and the specific, just as there are two genera of inflammations. Common ulcers are such as are produced by ordinary causes, as common inflammations, abrasions, and wounds; specific ulcers, on the contrary, owe their origin to the operation of some peculiar virus, as the poison of syphilis, smallpox, glanders, malignant pustule, scirrhus, encephaloid, tubercle, or melanosis. Although the ensuing remarks are more particularly intended to illustrate the various forms of common ulcers, yet they are also, in some degree, applicable to the specific, which, however, will receive special attention in their proper place.

1. ACUTE ULCERS.

The acute ulcer is distinguished by the rapidity of its progress, and the severity of its symptoms, which are those very much of ordinary acute inflammation. The sore usually begins at a small point of skin, or skin and cellular tissue, from which it speedily spreads in different directions until it often covers a large extent of surface. In its form it is generally somewhat oval or circular, but it is frequently very irregular, and instances are met with in which it is of a serpiginous, creeping, or angular shape. When the ulcerative action commences simultaneously at several spots, as occasionally happens, the sore may have a peculiar sieve-like, or worm-eaten appearance, similar to that of the cover of an old book, or the bark of a tree. Its surface is red and angry-looking, either uniformly, or red at one point, and white at another, owing to a deposit of aplastic matter, which occasionally overspreads it completely. When the action is unusually severe the bottom of the ulcer generally exhibits a foul, greenish, brownish, or blackish appearance, and, if under such circumstances, any plasma is poured out, it is immediately spoiled or washed away by the discharges, which are always profuse, thin, sero-sanguinolent, and irritating, possessing none of the properties of laudable pus, such as is furnished by a granulating wound. In regard to the edges of this class of ulcer, they present the greatest possible variety; in general, however, they are thin, rather sharp, and somewhat undermined, or undermined at one place, straight at another, and perhaps everted at a third: in some cases they are very steep and ragged, notched or serrated. Extending from the sore in different directions are occasionally small sinuses or fistulous passages, which thus greatly complicate its character and protract the cure. The parts immediately around the ulcer exhibit all the phenomena of high inflammation, being of a deep red or purple color, preternaturally hot, painful, and more or less œdematous from sero-plastic effusions, and consequently pitting under pressure. The latter symptom is hardly ever entirely absent in any case of acute ulcer, and is therefore of great diagnostic value. The œdema often extends over a considerable

surface, but is always most conspicuous in the immediate vicinity of the sore. The same remark is applicable to the other inflammatory phenomena.

The pain of the acute ulcer is frequently a prominent and absorbing symptom; it varies not only in degree but likewise in character, being at one time throbbing, or pulsatile, at another sharp or pricking, at another dull, heavy, and gnawing, as if insects were feeding upon the part. Its violence is often altogether disproportionate to the extent of the morbid action. I have seen cases, where, although the ulcer was scarcely as large as a twenty-five cent piece, it was so excruciating as to deprive the patient of sleep for days and nights together, and bring on rapid emaciation and hectic irritation. It may be limited to the sore, but in general it is felt over the whole of the inflamed surface, and is usually worst at night and in damp states of the atmosphere. Posture also commonly aggravates it, being generally more severe when the part hangs down than when it is elevated, although I have occasionally found the reverse to be true, even when the sore was quite large.

Along with these phenomena there is generally considerable constitutional derangement, manifesting itself, commonly not so much in febrile commotion, as in an irritable state of the system, and disorder of the digestive organs. The patient feels unwell rather than sick; his head troubles him; his appetite is vitiated, or temporarily arrested; the tongue is coated, and there is a bad taste in the mouth, especially in the morning; the bowels are inclined to be constipated; and the urine is scanty and high-colored. When the ulcerative action is rapid and extensive, there is frequently more or less fever, with thirst, restlessness, loss of sleep, and excitement of the pulse. Disorder of the secretions is generally a prominent symptom in these cases, especially of the liver, the uterus, and mucous follicles.

An impoverished state of the blood, however induced, habitual intemperance, excessive indulgence at table, mental anxiety, exposure to cold, and the various eruptive diseases may be enumerated as so many predisposing causes of the acute ulcer. Nervous, irritable, and plethoric persons, especially old dram drinkers, are its most frequent subjects. Both sexes are liable to it, but men suffer much more frequently than women. The malady is rarely met with in the higher circles of society, and it is also very uncommon in children.

The acute ulcer may be a primary affection, or an ulcer, after having been for some time in a dormant condition, may suddenly assume the acute character, either in consequence of local or constitutional causes, or of both combined; that is, the part becomes more or less severely inflamed, and manifests a tendency to extend its ravages. However this may be, the disease often spreads with great rapidity, eating away everything with which it comes in contact—skin, cellular tissue, fibrous membrane, muscle, and sometimes even bone—and often laying waste in a few days an extent of surface which it may take months, aided by the best skill, to repair. When this is the case, the action may be said to be truly phagedenic, or to consist in rapid mortification of the molecular structure of the suffering part, which

is hot, œdematous, fiery red, exquisitely painful, and bathed with profuse, fetid discharges. Constitutional disturbance is great, and the tendency is usually decidedly typhoid, especially if the subject of the disease has been worn out by intemperance and other causes of depression. This form of ulcer is very prone to occur upon new and imperfectly organized skin, where it often commits the most terrible ravages, which, for a time, hardly anything can successfully resist.

Treatment.—The treatment of the acute ulcer must be conducted upon strictly antiphlogistic principles, modified, of course, by the peculiar exigencies of each particular case. When the symptoms are urgent, as denoted by the severity of the local and constitutional disorder, the indication obviously is to take blood from the arm, provided the patient is at all plethoric, or, this not being permissible, at all events to open his bowels freely with an active cathartic, containing from five to ten grains of calomel, and followed up, if necessary, in six or eight hours, by infusion of senna and sulphate of magnesia; recourse is then had to the antimonial and saline mixture, to subdue vascular action; and opium is administered in large doses to allay pain and induce sleep. The diet must be mild, and not too nutritious, and the patient must observe the most perfect rest in the recumbent posture. Active purgation will be found of the greatest value in this form of ulcer; in fact, it is difficult to imagine a case in which it could be entirely dispensed with. To render it promptly effective, however, I have long been in the habit of combining with it a certain quantity of mercury, either in the form of calomel, or blue mass, with a view of making a strong and rapid impression upon the secretions, which, as before stated, are usually notably deranged, and which thus keep up a spreading tendency in the disease. Of the beneficial effects of anodynes in arresting acute ulceration no one can form any just conception, who has not witnessed them in practice. That they exert any direct influence upon the part itself cannot be supposed; but that they produce a most salutary impression by tranquillizing the heart's action, and allaying nervous irritability, which is generally so prominent a symptom in this affection, is indisputable; hence the remedy should always be given in large and sustained doses from the very commencement of the malady.

It is not to be inferred from the remarks now made, that active depletion is suited to all cases of this disease; on the contrary, we are often obliged to use tonics and stimulants at the very beginning of the treatment, and to continue their exhibition until we have succeeded in building up the system, so as to enable it to oppose a successful barrier to the encroachment of the morbid action. The state of the pulse, skin, digestive organs, and muscular system will generally serve as a correct guide to the kind of treatment best adapted to meet the exigencies of this class of cases. Quinine and milk punch, with opium, or the salts of morphia, will usually constitute the most reliable means.

The local treatment will not differ, in its general principles, from that already described as applicable to acute inflammation, except as it respects the modifications arising from the presence of a broken

surface. The part, as a primary and essential step, must be placed perfectly at rest in an easy and elevated position, to prevent arterial ingress and favor venous return; it will even be well, in many cases, to place the limb upon an inclined plane, so that the sore shall be higher than the rest of the body, and to confine it, if necessary, in this situation by means of a light roller, care being taken not to obstruct discharge or to make undue compression. If the part be filthy from want of cleanliness, or adherent dressings, ablution by immersion precedes direct medication. If the morbid action be high, the young practitioner might be induced to apply leeches, not to the sore, but in its immediate vicinity; but to such a proceeding I must enter a decided demurrer, for the reason that these animals, even if employed ever so cautiously, will always occasion excessive pain, to say nothing of the fact that their bites are sometimes followed by an aggravation of the inflammation and ulceration. A much better plan, according to my experience, is to draw blood by scarification by means of a lancet, the limb, the while, standing in a tub of warm water, with a cord thrown firmly round its upper extremity, a few inches below the knee. From six to a dozen vertical incisions, not quite skin deep, are made over the inflamed surface around the sore, the blood being permitted to flow until the patient shows signs of approaching syncope, if he be at all plethoric, or, at all events, until the engorged vessels have been measurably deprived of their contents, as denoted by the comparative pallor of the part. I know of no method which is so well calculated as this to make a prompt and decisive impression upon an acute ulcer; it is a most potent alterant, and I rarely omit its employment whenever the case presents the slightest urgency. For the sore itself the best remedy is a weak solution of acid nitrate of mercury, in the proportion of one part of Bennett's formula to two, three, or four parts of water, according to the foulness of the affected surface. The application should be made lightly with a soft sponge or cloth mop, and may, if necessary, be repeated once in the twenty-four hours until there is a decided improvement in the condition of the ulcer, when it should be entirely dispensed with, or used more sparingly, and still weaker. As a constant cover for the part the most suitable remedy will be a light emollient cataplasm, sprinkled with morphia, laudanum, or powdered opium, or the warm water-dressing, simple or similarly medicated. Fetor is allayed with the chlorides. In some instances yeast may be advantageously added to our poultices; but in general this may be dispensed with. Under this treatment we may usually look for rapid improvement; in many cases we have the satisfaction to find, within less than thirty-six hours after its commencement, already a decided change for the better; the ulceration evinces a disposition to cease, the discharges assume a more healthy aspect, and the surrounding parts lose their fiery red and œdematous character. By persevering in the treatment, in a modified form, the sore will soon begin to granulate, and to form new skin along the margin of the old, and this point being attained, none but the mildest applications will afterwards be required.

Such, in a few words, is an outline of the treatment which, when a

choice of remedies is allowed, I usually adopt in this disease. But the patient will not always submit to scarification, nor is this always proper, owing to the exhausted condition of his system. Under such circumstances, our object may often be promptly attained by the free application of the dilute tincture of iodine to the parts around the sore, while the sore itself is lightly touched with the acid nitrate of mercury, as in the former case, or with a strong solution of nitrate of silver, or this article in substance, although both are decidedly inferior to the former remedy. In some instances I have succeeded in putting a prompt and permanent check to the ulcerative action by covering the sore and the inflamed surface with a blister, keeping it upon the parts until thorough vesication has been established, and then using the ordinary dressings. I am persuaded that few cases of acute ulcers can resist this remedy, and I can speak of it with great confidence from repeated personal trials. Its beneficial effects are no doubt due to the drainage which it establishes and the consequent change in the action of the capillary vessels. The progress of the cure is sometimes embarrassed by dead matter, as shreds of cellular tissue or fibrous membrane, the removal of which should receive prompt attention.

Of creasote, sulphate of copper, acetate of lead, and other remedies so much lauded by some practitioners in the treatment of acute ulcers, little need be said. These articles undoubtedly possess some merit, and I have occasionally employed them with advantage, but as they are altogether of a subordinate character they should never take the place, in urgent cases, of those just mentioned. Acetic and nitric acid, the former in the proportion of one drachm to the ounce of water, and the latter in the proportion of eight or ten drops to that quantity of fluid, are excellent applications, in the milder varieties of the affection, allaying fetor and changing the action of the sore so as to promote the formation of healthy granulations and laudable discharge.

2. CHRONIC ULCERS.

While it is not always easy to determine when an ulcer becomes chronic, it is to be borne in mind, as was previously stated, that a chronic ulcer may, in consequence of local and constitutional causes, occasionally assume an acute character. In this respect the present disease does not differ from ordinary inflammation, unattended by breach of texture. Thus, an inflammation of the conjunctiva, after having pursued a chronic march, with but little pain and discoloration, perhaps suddenly, at the end of several months, breaks out with renewed vigor, characterized by all its primitive intensity, and now rapidly urging on the affected structures to permanent disorganization, rendered the more prone to this occurrence by their protracted suffering. Ulcers are not unfrequently subjected to similar hardships; not once only, but, perhaps, many times during their progress, and thus their career often becomes a most checkered one, defying alike our powers of diagnosis and treatment, and constituting at least one of the causes, previously adverted to, of the *outré* nomenclature which disfigures this branch of the art and science of surgery.

When does an ulcer become chronic? or, in other words, what time must elapse before it can be said to possess this character? To this question it is impossible to give anything like a definite reply; in some instances the disease is chronic almost from the beginning; in others, it becomes so in a few weeks, and in others again, perhaps several months intervene. The term chronic, as every one knows, has reference to time, and is employed to designate a class of affections which have passed through their acute stages, and which, consequently, have been deprived of their primitive characteristics; their action has been modified by treatment, or by the operation of time, or the joint influence of both. The inflammation now generally exists in a much milder form; there is less functional disturbance, while the constitutional derangement often entirely ceases, and the local phenomena of heat, redness, pain, and swelling are materially diminished. The part, however, is oppressed, if not overpowered, by effused fluids, its vessels are sluggish, dilated, and engorged with dark blood; nervous sensibility is perverted, and the restorative tendency is either much enfeebled or else completely at a stand. Ulceration still goes on, and perhaps even serious havoc is committed by its action, but that action is tardy, and exhibits few, if any, of the phenomena which characterized it in the first instance. It would seem, at first sight, as if it were a paradox to say that a disease was chronic from its commencement, and yet such is, nevertheless, the fact, rather, however, in reference to its symptoms than in regard to the true and legitimate meaning of the word. But upon this subject I have already dwelled at some length in a former chapter, and I shall therefore not enter into any minutiæ respecting it here.

Chronic ulcers often exist for many months and years together; at one time stationary, now receding, and now advancing; in one case exhibiting too much action, and in another too little, but rarely in a condition to furnish the requisite amount and quality of reparative material. Even if granulations occasionally do form, they are seldom of a healthy character, or, if they are, it is seldom that they long retain it; on the contrary, they soon languish for the want of proper support, or they perish from the violence of the attendant inflammation. These effects may be the result purely of local causes, or of causes exerting their influence indirectly through the constitution; but in the majority of cases they are, there is reason to believe, the consequence of the operation of both. If this statement be true, as multiplied observation proves it is, we cannot fail to deduce from it important principles of practice. It plainly suggests to us the necessity, in every instance, of instituting a careful inquiry into the nature of the exciting cause and the condition of the system, as well as the state of the part itself. To treat a chronic ulcer upon any other plan would be a palpable absurdity; and yet that this is generally the case my experience amply attests. Few practitioners look upon this class of diseases in the true light of philosophy; their ideas of their pathology are vague and indistinct; and it is therefore not surprising that they should find themselves completely baffled in their attempts at curing them. It is for this reason that chronic ulcers of the legs have so long been

regarded as an opprobrium of surgery, and that so many patients are obliged to carry their malady with them to the grave, notwithstanding the numerous attempts that may have been made to get rid of it; all arising from the fact that its true nature was never properly understood.

The chronic ulcer is capable of assuming every possible variety of seat, number, form, size, color, condition of surface, and complication. In general, it is found to occupy the inner surface of the leg, a few inches above the ankle; but it is often situated higher up, and in rare cases it is placed directly over the joint itself. The outer surface of the limb is also liable to suffer, and we occasionally meet with instances of ulcers existing simultaneously upon both sides. In fact, no part of the leg is wholly exempt from the disease, unless it be that just below the knee. Why this liability should exist to a greater extent at one point than at another is a circumstance which we are unable to explain. Is it owing to the fact that the inner surface of the limb is more liberally supplied with veins, and, consequently, more subject to habitual congestion of the skin and cellular tissue? Such an idea is not improbable, but whether it is correct, we have no means of determining.

Fig. 20.



Chronic ulcer with deep edges, partially undermined, and a foul unhealthy bottom, studded with fungous granulations.

The form of the ulcer is variable, being at one time circular, now oval, and then angular, or so irregular as to defy all attempts at accuracy of description. In some cases, it extends round the limb in the form of a belt nearly of equal width. In size it ranges from that of a five-cent piece to that of the palm of the hand, or even the entire hand, the destruction of substance being truly frightful. In its depth, it rarely reaches beyond the subcutaneous cellular tissue; in some cases, however, it involves the aponeuroses, the muscles, and even the bones and cartilages. Such ravages generally imply an unusual amount of antecedent inflammation, or the repeated intervention of acute action, although they are often produced by the steady progress of the chronic disease itself.

The chronic ulcer is often solitary; but it is not uncommon to meet with two, three, or even a larger number, situated either in close proximity with each other, or at different, and perhaps rather remote, points of the limb. When the number is considerable, their size is usually proportionably small.

The color of the ulcer varies from light rose to deep purple, according to the intensity of the concomitant action and the congested condition of the cutaneous capillaries. The most common shades of color are the dusky, brownish, and light livid, but it is worthy of note that an ulcer which is of a rosy hue to-day may be of a deep purple to-morrow, simply in consequence of a change in the condition of the inflammatory action. The parts around the sore are often quite as high colored as the sore itself; sometimes, indeed, much more so. In general, the discoloration, whatever may be its character, is lost by insensible gradations in the surrounding healthy hue, not abruptly, as in erysipelas and erythema.

In regard to the edges of the chronic ulcer, nothing can be more diversified; hence, some of the singular distinctions of Home, Astley Cooper, and others who have followed so closely in each other's footsteps. In general, the edges are hard or callous, elevated, rather broad, and so insensible as to admit of the rudest manipulation; in some cases, they are thin, ragged, almost serrated, and either everted or inverted, and perhaps exquisitely sensitive. In another class of cases, by no means infrequent, they are considerably undermined, or shelving at one point and everted at another. In fact, there is no end to the diversities presented by the boundaries of the sore; hence, all attempts at description must be futile.

The surface of the sore is generally more or less irregular, being deeper at one part than at another, although, as was before stated, it rarely extends beneath the subcutaneous cellular tissue. Its real condition usually varies with the amount of inflammatory action. When this is considerable, there is often an entire absence of granulations, and then the bottom of the sore will generally be found to be in a foul, bloody, or phagedenic condition, or incrusted with a stratum of lymph too feeble to admit of organization; or, finally, granulations, sloughy matter, and vitiated plasma may all be present, in varying degrees, upon different parts of the exposed surface. The concomitant discharge is profuse, sanious, fetid, and irritating, possessing none of the properties of healthy pus. The sore, as well as the surface immediately around, is unusually sensitive, and often the seat of severe pain. It is to this form of ulcer that writers usually apply the term inflamed, or irritable, from its excess of vascular and nervous activity. It is most common in nervous, irritable subjects, and in persons who are habitually intemperate. It is of frequent occurrence.

When the inflammation is more moderate, granulations will seldom be wholly absent, and they may exist even in great abundance, although they may be altogether unhealthy in their character. When the action is somewhat less, but not too languid, they commonly exhibit a pale, reddish, flabby appearance; their surface is irregular or tuberculated, and they are much too large; in fact, they look as if they had been reared in a hot-bed, and had been too freely watered. Their reparative power is very feeble, and we are often obliged to get rid of them entirely before we can effect a cure. This state of granulation constitutes what is vulgarly called "proud flesh," of which many examples occur in practice.

Again, the circulation may be inordinately languid, and then the granulations, if any be present at all, will generally be still larger than in the preceding case, totally insensible, and perhaps quite œdematous, a serous, or sero-sanguinolent fluid freely exuding from them if punctured, and readily pitting under pressure. Cacoplastic lymph is generally interspersed through the granulations, or adherent to the surface of the sore, the edges of which are hard and very prominent, so that the raw surface appears as if it were much below the level of the surrounding parts, which, however, is seldom the case. The accompanying discharge is slight, thin, and sero-sanguinolent; and the adjoining skin is œdematous and of a dusky brownish hue.

Finally, cases occur where the granulations are very small, or apparently stunted in their growth, irregular in shape, of a fiery red color, and so exquisitely sensitive as to be a source of great suffering, the ulcer being intolerant of the slightest pressure, or manipulation; the discharge is sanious and irritating, although seldom very fetid or profuse; the edges of the sore are thin, irregular, everted, or inverted; and the surrounding skin is the seat of active inflammation.

The chronic ulcer is often complicated with other diseases, which tend to modify its action, and impede, if not entirely prevent, its restoration. Of these affections some are of a local, others of a general character. The former consist mainly in the involvement of the deep-seated structures, as the fibrous membranes, tendons, muscles, and bones; in the formation of sinuses; in a varicose state of the veins; and in the presence of foreign matter, under the influence of which the ulcer was, perhaps, originally induced. Among the constitutional complications the most common are, disorder of the secretions, especially of the liver and alimentary canal, anemia, dyspepsia, plethora, and habitual intemperance in eating and drinking. I have never seen what writers have called the menstrual ulcer, although it is not to be doubted that great uterine derangement, showing itself in deficiency of discharge, might seriously interfere with the healing of a sore on the leg, or indeed, in any other part of the body.

Treatment.—In the management of chronic ulcers three leading indications present themselves; first, to remove any complications that may exist; secondly, to regulate the inflammatory action; and thirdly, to produce healthy granulations. Keeping before him these important points, to the attainment of which all his energies should be steadily directed, the practitioner cannot fail to settle down upon a rational and philosophical plan of treatment, one which must, sooner or later, be crowned with success. Let him not lose sight of common sense, but proceed precisely as if the disease were one of ordinary inflammation, modified merely by accidental circumstances, and he will be sure to go right. His object should be, in every case, to bring the ulcer into a simple granulating condition, so as to give nature an opportunity of beginning and carrying on, without impediment, the healing process.

Ulcers sometimes refuse to heal in consequence of the partial destruction of aponeurotic, tendinous, or muscular tissue, or the manner in which the parts are compressed by overlying structures: in the

former case, the dead substance is removed with the knife or scissors, while in the latter relief is afforded by adequate incisions, after which the malady is treated upon general principles. If necrosed bone exist, this must be extracted, while caries must be cut away with the chisel, saw, or scalpel.

Varicose veins are to be dealt with according to the rules laid down for the management of that disease in a subsequent chapter; the complication is often a serious one, and nothing short of the ligation of the vessels, or their destruction by the Vienna paste, will answer the purpose. When the malady is comparatively slight, amelioration may be afforded by wearing a laced stocking to give uniform support to the limb, and by the free use of spirituous lotions, with the occasional application along the track of the enlarged vessels of the dilute tincture of iodine. Hemorrhage sometimes attends this complication, from extension of the ulceration into a contiguous vein; I have seen cases where more than a quart of blood has been thus lost in a few minutes, and two instances have been reported to me where the bleeding was so copious as to prove fatal. The proper remedy is compression with the compress and bandage, followed, if need be, by a Vienna paste issue to produce permanent obliteration of the vessel at the seat of the ulceration.

Sinuses are to be laid open with the director and bistoury, their course being completely traced out, as no cure is to be expected so long as any portion remains concealed. Reunion of the incision is opposed by the tent and careful dressing.

Ulcers, consequent upon wounds, are frequently prevented from closing by the presence of foreign matter, as a pellet of paper, a piece of cloth, a ball, nail, or fragment of bone; when this is the case a careful search is made with the probe, and the substance extracted in the usual manner.

One of the worst complications in chronic ulcers occasionally arises from the edges of the sore being undermined, inverted, uncommonly ragged, or very callous. The best procedure is to use the knife, cutting off all that is spoiled, redundant, or irreclaimable. Exuberant granulations are dealt with in the same manner, excision here being far preferable to escharotics, which are always painful, tedious, and uncertain.

The second object is to reduce the concomitant inflammation so as to enable the sore to form healthy granulations, which it cannot possibly do so long as the morbid action is either very high or very low. One step towards accomplishing this end is the removal of complications, which, indeed, is frequently of itself sufficient to effect a cure. When this fails, the rest of the inflammation is often readily relieved by the use of the dilute tincture of iodine to the parts immediately around the ulcer, preceded, when the congestion and discoloration are unusually great, by free scarification; and by touching the sore itself very gently, once a day, with the solid nitrate of silver, or, what is better, the acid nitrate of mercury, either in its pure state or variously weakened, according to the exigencies of each particular case. One application of the acid will usually suffice in the twenty-four hours,

and in many instances the cure will progress more rapidly and satisfactorily if it be made less frequently. Other topical remedies may often be used with advantage, especially the nitric acid lotion, and weak solutions of sulphate of copper, acetate of lead and zinc, sulphate of zinc, creasote, and acetic acid. All these articles, however, are of a subordinate character, and hence I seldom have recourse to them. As a constant protection for the parts, nothing is more suitable than the elm or linseed cataplasm, which, notwithstanding the abuse that has been heaped upon it in certain quarters, is still, in most cases, one of our nicest and most reliable remedies. Or, instead of the poultice, the warm water-dressing may be used, although this is generally much less convenient in private practice, and not any better. When the pain is very great, the application should be medicated with solutions of morphia, or morphia may be sprinkled directly upon the surface of the ulcer.

During all this time, proper attention is to be paid to the state of the system; the bowels are to be regularly moved with mild aperients, and care is taken that the diet is perfectly mild and not over-nutritious. If the general health is much disordered, recourse is had to more active purgation, and free use is made of the antimonial and saline mixture, with a full opiate at night, if there be much pain, or inability to sleep. Bleeding at the arm will only be required in very plethoric subjects, in urgent cases. Absolute recumbency is observed, at least until the morbid action has been measurably subdued; and the affected part is placed at rest in an easy and elevated position, just as in ordinary cases of inflammation.

Fig. 21.



Granulating ulcer, beginning to cicatrize; the process extending from the periphery towards the centre.

If the general health is much reduced by protracted suffering, or if the system is in an anemic condition, or, finally, if typhoid symptoms are present, stimulants and tonics will be indicated, especially quinine, with milk punch, and nutritious food.

If the measures now detailed be judiciously employed, the surgeon will soon be able to get the ulcer into a condition for the development of healthy granulations (fig. 21), and, as soon as this has been brought about, he will have little else to do than to watch the parts, with a view to the prevention of over-action. The mildest and most soothing applications will now generally suffice, the object being rather to protect the surface of the sore from the injurious contact of the atmo-

sphere, than to promote its action by medicative agency. Among the best of these remedies are the cerates of opium, balsam of Peru, oxide of zinc, and, last, but not least, of the nitrate of mercury, which I prefer to all others, on account of its cicatrizing properties. It must, however, be employed with care, and in a very weak form, as in the proportion of six, eight, or ten grains to the drachm of simple ointment. The scabbing process may occasionally be expedited by touching the granulations along the edge of the sore, once a day, very lightly, and for the space of a line, with the solid nitrate of silver.

I consider rest, in the treatment of ulcers, as a matter of paramount importance in all cases where it is desirable to effect a rapid cure; I am certain, from much observation, that nothing else is at all comparable to it. Nevertheless, instances often occur where, either on account of the patient's condition in life, or the exhausted state of his health, exercise in the open air is absolutely indispensable; under these circumstances, the part should be as carefully protected as the exigencies of the case will admit of, fatigue and protracted dependency being especially guarded against. In such cases, the bandage becomes usually a powerful adjuvant both to comfort and cure; but it must be applied equably from the distal part of the limb upwards, and not in folds or creases, otherwise it will do infinite harm. It must be changed at least once a day, being replaced as soon as the extremity has been thoroughly cleansed and the sore properly dressed. In hot weather, it may occasionally be kept constantly wet, with good effect, with cold water, spirituous lotions, or weak solutions of lead and opium.

Many practitioners are fond of strapping the sore and the adjacent parts with adhesive plaster, cut into strips varying from an inch to an inch and a half in width, and long enough to extend about three-fourths around the limb, each band being so arranged as to overlap that which is below it, and drawn so firmly as to afford uniform support to the affected surface (fig. 22). This plan of treatment, however, which is known as that of Mr. Baynton, by whom it was first suggested, has many disadvantages, of which one of the most objectionable is the impossibility of watching its effects, the sore being too much concealed from view. The method of Mr. Crichett, which has been recently brought under the notice of the profession, is, I conceive, still more disadvantageous; it consists in enveloping the entire foot and leg, for some distance above the ulcer, with adhesive plaster, a proceeding which,

Fig. 22.



Strapping of the indolent ulcer shown.

although it may answer very well in the hands of its originator, can hardly fail to prove mischievous in the practice of others less adroit and less experienced in the use of the remedy.

A few words may be added here respecting the proper method of dressing ulcers. To this subject usually too little attention is given, and the consequence is that the part often suffers great injury. All rude manipulation and protracted exposure must be avoided; the sore should never be wiped, or even touched with the finger, and, while the necessary ablutions are going on, the limb should be carefully supported over a basin or small tub, the water, which may be cold or tepid, being gently squeezed upon it from a sponge held several inches off. The secretions being thus disposed of, the surrounding surface is properly dried, and the dressing reapplied. If fetor be present, a little liquid chlorinate of soda may be mixed with the water employed in cleansing the sore, as well as sprinkled from time to time upon the poultice and bandage.

When a large extent of integument has been destroyed by the ulceration, or when the morbid action has a constant disposition to reappear, as so often happens, upon the imperfectly organized cicatrices of old sores, it has been proposed to cover the breach by borrowing the requisite amount of tissue from the immediate neighborhood, just as in the more ordinary plastic operations. The plan, which has been dignified with the name of *elkoplasty*, has been warmly advocated by Professor Hamilton, of Buffalo, in a short article which he published upon the subject in the New York Journal of Medicine, for 1854, in which he describes several cases of its successful employment. Dr. John Watson, of New York, had previously applied the same principles of treatment in a case of syphilitic ulcer of the forehead, the particulars of which will be found in the Americal Journal of the Medical Sciences, for October, 1844, under the name of mylopoplasty. To insure the union of the edges of the wound, it is necessary that the part should be quite free from inflammation, and that the general health should be as nearly as possible at the natural standard. The flap should be much larger than the gap in the limb, and should be well secured in its new position by the interrupted suture.

Whatever mode of treatment be employed, it is of paramouut importance, as it respects the prevention of relapse, that the patient should observe great care in regard to his diet and exercise, for a number of weeks after the ulcer has completely healed. If he indulges his appetite too soon, neglects his bowels, or allows his secretions to become disordered, he can hardly escape a new outbreak of the disease; especially so if, at the same time, he fatigues his leg much, allows it to hang down constantly, constricts it improperly with his garter, or rubs it with his boot.

In inveterate cases, extensively involving the osseous tissue, greatly impairing the general health, and resisting the best efforts of the surgeon for their relief, the only resource is amputation, performed through a sound portion of the limb. I believe, however, that such a procedure will rarely be demanded in these days of conservative surgery; for, unless the bone be almost entirely destroyed, it will be

easy, in the majority of instances, to dispose of the diseased structures with the knife, gouge, and mallet; or by a resort to resection.

In conclusion, we may ask the question whether it is always safe and proper to heal old ulcers? Upon this subject, various opinions have been expressed by writers on surgery. Those who assert that it is not, assume that a sore of this kind acts, when it has existed for a great length of time, as an issue, which serves the purpose of a safety-valve to the system, by ridding it of redundant, if not positively peccant, humors. They allege that cases have occasionally been witnessed where attacks of cerebral apoplexy, and other serious diseases, have occurred as the direct and speedy consequence of the drying up of such sores. Those, on the contrary, who espouse the opposite side of the question, declare that such occurrences are mere accidental circumstances, readily explicable by the laws of coincidence; and such is the view which I am myself inclined to adopt. I do not believe that medical science possesses any well-authenticated facts by which this opinion can be sustained. I have often cured ulcers of five, ten, and even fifteen years' standing, constantly attended with more or less discharge and irritation, and yet it has never fallen to my lot to meet with a solitary instance to which such an event could justly be ascribed. Besides, the constitutional treatment which is usually necessary in these cases to effect a cure, is, in itself, almost a guarantee against attacks of grave disease in other parts of the body. If, however, any one should feel inclined to adopt a different view, it would be easy, while the sore is being dried up, to protect the system against such assaults, by ordering a continuance of the constitutional remedies, especially a spare diet, and the occasional use of a purgative, conjoined with the employment of an issue in a remote part of the body, as the arm, chest, or neck.

SECT. IX.—GRANULATION.

Granulation is the process by which lost tissues are repaired and wounds healed when they refuse to unite by the first intention, or adhesive action. The operation is one of great interest, whether it be viewed merely as a physiological phenomenon, or as a means employed by the system to restore injured and mutilated structures. An intimate knowledge of its nature and habits is therefore of paramount importance to the surgeon.

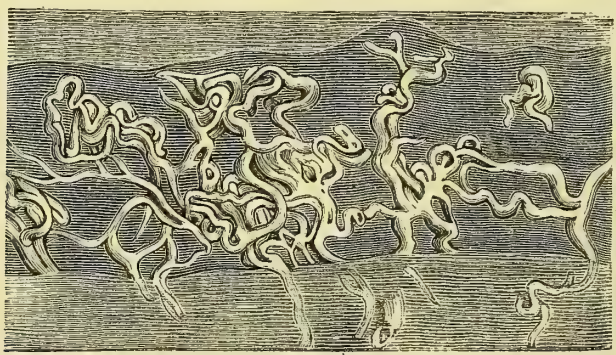
It is chiefly upon the external surface of the body that we have an opportunity of examining the process in question with any degree of satisfaction. In the various mucous outlets it is more difficult to watch it, and to trace it through its different stages; while in the internal organs it either does not occur at all, or is observed only as a post-mortem appearance.

Before granulation can begin, it is necessary that there should be a reduction of the inflammation of the part, however it may have been induced; I do not mean to say by this remark that all the inflammation must be got rid of as an essential preliminary, for I believe that

more or less of this action is absolutely necessary to its successful operation; I merely wish to declare that granulation cannot go on so long as there is any considerable degree of inflammation; or, what is the same thing, that high vascular excitement and repair are, as a general rule, incompatible with each other. The balance of action having thus been re-established, the breach soon becomes covered with a layer of lymph, which, undergoing organization, is rapidly converted into red, fleshy-looking bodies, technically denominated granulations. By a continuance of this action the process of repair steadily progresses until the gap is finally filled up and scabbed over.

A granulation is a curious and interesting body, as well as a body of great consequence. It is highly organized, and therefore capable of executing very important functions. Under the microscope it is found to consist of cells, without any very definite arrangement, and connected by a small quantity of intermediate substance, the precise nature of which is not understood. It is usually of a florid color, very vascular, extremely sensitive, and of a conical, rounded, or oval shape, its volume varying from that of a clover-seed to that of a large shot. Minutely studied, it is found to consist of numerous vessels (fig. 23), which are evidently sent into it as outgrowths from those of

Fig. 23.



Arrangement of the bloodvessels in a granulation.

the adjacent parts, being arranged in the form of beautiful loops and arches, closely interwoven with each other. As they are developed with great rapidity, their walls are at first so extremely delicate as to yield under the slightest pressure; hence there is generally more or less hemorrhage from whatever is brought into rude contact with them. The veins, which are very large, exhibit, when viewed with a magnifying lens, a remarkably tortuous and convoluted appearance. No nerves are demonstrable in this body, but that it receives an abundant supply of this kind is shown by the fact that it is often very sensitive, especially when it is in a state of disease. The existence of lymphatic vessels is also a matter rather of inference than of positive observation. Experience has proved that certain articles, placed in contact with a granulating ulcer, will be promptly taken up, and carried into the sys-

tem, producing the same effect, and nearly in as short a time, as when introduced in the ordinary manner. Thus, morphia will readily allay pain and induce sleep; atropia, dilate the pupil; arsenic, irritate and inflame the stomach; strychnia, convulse the muscles. Moreover, a granulation is a secreting body, a kind of compound gland, capable of pouring out plasma and providing the elements of pus; the former for enlarging its own dimensions and multiplying itself, the latter as a means of defence from the atmosphere and from the surgeon's dressings.

Granulations form with various degrees of facility, depending mainly upon the structure of the part and the amount of inflammatory action. Ulcers of the skin and cellular tissue always, other things being equal, furnish them most readily, as well as in most abundance; a circumstance which is not surprising when we reflect upon their extreme vascularity and high nervous endowment. Bone, cartilage, tendon, and fibrous membrane, on the contrary, granulate more slowly, and hence their injuries are always repaired with more difficulty. The same remark applies, but in a more pointed manner, to scirrhous and other malignant ulcers.

Granulations are liable to disease. This often occurs from causes apparently the most insignificant; depending, perhaps, at one time upon the state of the part, at another upon the state of the constitution, or upon both combined, but more frequently upon the nature of the dressing, and the indiscretion of the patient. Hence, the appearance of these bodies usually serves as an index of the concomitant action, local and general, and affords useful indications of treatment. The most important alterations which they undergo are such as relate to their size, color, consistence, and sensibility. Healthy granulations are generally small, not exceeding the volume of a mustard-seed, but cases occur in which they are many times larger. Their natural color is a beautiful florid; when congested or inflamed they assume a livid aspect, while under opposite states they are occasionally quite pale, or even blanched. In their consistence these bodies also present much diversity, being sometimes very soft and lacerable, and at other times very firm, inelastic, and almost callous. Occasionally they have an infiltrated, œdematous, or dropsical appearance, serum escaping freely upon the slightest puncture. Their sensibility is usually very feeble, but in nervous, irritable persons they are sometimes exquisitely sensitive, particularly when they happen to be much inflamed. In ulcers from burns the granulations are always distinguished by their excessive tenderness.

The discharge furnished by these bodies is liable to vary in different cases and under different circumstances. When they are in a perfectly normal condition, as is indicated by their florid aspect, small size, and steady development, it is usually of a thick, cream-like consistence, and of a pale yellowish color, or, in other words, of the nature of laudable pus; if, on the other hand, they are inflamed and irritable, it will generally be thin and sanious, with an inordinate quantity of earthy salts; when the excitement is very high, the matter is usually mixed with

aplastic lymph; hard, callous granulations are often free from all discharge, being apparently incapable of furnishing purulent matter of any kind. In dropsical granulations the fluid is usually of a serous description.

The management of the granulating process must be conducted upon the same general principles as the ulcerative. The leading indication is to favor its development by protecting the raw surface from the atmosphere and from whatever else has a tendency to embarrass its progress. The most suitable applications, as a general rule, are water-dressing and emollient poultices, which should be employed in such a manner as, on the one hand, not to excite exuberant action by their warmth, and, on the other, not to repress growth by their refrigerant effect. Rude contact, protracted exposure to the air, and irri tating applications must be carefully avoided.

SECT. X.—CICATRIZATION.

Cicatrization is the completion of the granulating process, the last act in the operation of repair, the hermetic sealing, as it were, of the breach left by the destruction of the tissues of the affected part. If we study this process with proper care, we shall find in it much that is calculated to arrest attention and elicit admiration at the wonderful resources of the animal economy.

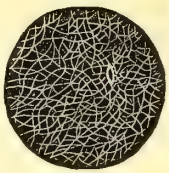
When cicatrization is about to take place, there must necessarily be a subsidence of the inflammation of the part, just as in the development of granulations, only to a still greater extent. This may be regarded as an essential preliminary. The next step is a deposit of plasma upon the edges of the breach, followed by its rapid organization and conversion into epithelial scales, a thin, bluish, or whitish pellicle, which forms a striking contrast with the granulations and adjoining skin, indicating the progress of the change. The new substance may always be easily detached with the sponge or finger; for as yet its consistence is very slight. Gradually, however, it becomes more thick and firm, assimilating itself more and more closely to the pre-existing integument, the place of which it is intended to supply. The process thus begun continuing, the plastic, organizable film extends steadily onward until the exposed surface is finally completely covered in, the length of time necessary for this varying according to the size and shape of the breach, the absence or presence of complications, and the state of the system. Observation has shown that ovoidal ulcers, all other things being equal, heal more rapidly than circular, superficial than deep, common than specific. It is also well known that cicatrization is usually more easily accomplished in the upper extremities than in the inferior, and in the skin and cellular tissue than in the other structures. In the organs, properly so called, it generally takes place with difficulty, and only after a long interval.

It is a law of cicatrization that the process shall always begin, as the starting point, at the edges of the breach which it is designed to repair, and thence proceed towards the centre. So uniform is this

occurrence that I have seen but few instances to the contrary, notwithstanding the numerous and diversified cases which have been thrown in my way. It would seem as if the aid of the pre-existing tissues were necessary in order to enable the new substance to obtain a proper foothold. I am aware that a different doctrine has been promulgated by some, and there is, no doubt, occasionally an instance where the process proceeds in an opposite direction, after having commenced at a central point; but if this be so, it forms merely an exception to a general law, and not the law itself. Those who assert that this occurrence is rather frequent than otherwise may have been deceived by the existence of a small fragment of old tissue, with or without integument, which, standing like a little island in the midst of the ulcer, thus becomes the nucleus of the new structure. In this event, however, there is obviously no new law in force, but simply an application of the one already described.

Some time necessarily elapses, after the cicatrization is completed, before the new structure, now called a *cicatrice*, acquires much solidity and strength. It is only by degrees that it loses its bluish appearance and assumes the properties of the pre-existing substance. Even then it is at best only a very imperfect copy of the original, although it is capable of supplying its place and of executing the functions which nature has allotted to it. Its vessels, which are, at first, remarkably large and tortuous, gradually dwindle down to a size approximating them to those in the adjacent sound parts, and, when fully formed, they generally exhibit a beautiful retiform arrangement, as is shown in the annexed sketch (fig. 24). The scar always remains tender for a considerable period after its formation, and is usually very liable to break, crack, or ulcerate from very slight causes. Its tendency to contract or diminish also continues for a while longer.

Fig. 24.



Structure of a cicatrice of the skin.

What I have said respecting the imperfect reproduction of skin is equally applicable to the other textures. New bone comes perhaps nearer to the original structure than any other; but even this presents many peculiarities, and it is certain that it often acquires a degree of hardness and solidity far greater than the primitive substance. There are, moreover, some pieces of the skeleton which, when broken, never unite by osseous matter, but only through the medium of fibrous tissue, fibro-cartilage, or cartilage. Fractures of the patella, the olecranon, the acromion process of the scapula, and the neck of the thigh-bone within the capsular ligament, are generally, if not always, repaired in this way, the parts not having the power of secreting phosphate and carbonate of lime, in consequence of their imperfect supply of blood and nervous influence, to say nothing of the difficulty of maintaining the ends of such fractures in contact for a sufficient length of time to afford them an opportunity of becoming consolidated. Cartilage is never perfectly reproduced after injuries; the new substitute is always very thin, hard, and of an unnaturally bluish tint. Tendon is renewed only in the case of subcutaneous section; never when it has been

lost by disease. Muscles usually unite through the medium of fibro-cellular substance. In fracture of the costal cartilages the consolidation is effected by bone. Bloodvessels and nerves are never regenerated; the continuity of the former cannot be re-established after complete division, on account of the retraction of their extremities; if a small piece of the latter is excised, the gap is supplied by fibrous tissue, very different from the pre-existing one, but, nevertheless, often sufficient to transmit the nervous fluid with little or no impairment of its influence. The cerebral, pulmonary, hepatic, splenic, salivary, renal, and seminiferous structures are incapable of reproduction, the new substitute being always of a cellulo-fibrous, or fibro-cartilaginous nature. Serous, mucous, and fibrous membranes are repaired in a similar manner. Thus it will be seen that a tissue, when seriously mutilated, is seldom perfectly reproduced, whatever pains may be taken to assist its efforts.

It is not surprising that a substance so imperfectly organized as a cicatrice should be liable to inflammation and its consequences, as well as to some of the heterologous formations. Its powers of resistance being naturally feeble, it yields, in general, more readily to disease, whether simple or malignant, than the original structures. It is for this reason that inflammation of the substitute-tissue is prone to pass into ulceration, and, if the morbid action be at all severe, even into mortification. In suppuration, the matter furnished by the part is nearly always of a thin, ichorous nature, a development of genuine pus being almost impossible under any circumstances.

The most common form of malignant disease liable to show itself in a scar is epithelial cancer or lupus; it may break out upon any part of the body, but is most prone to appear upon the face, hands, and feet, parts which are habitually exposed, or frequently subjected to pressure and friction. The diseased structure, almost of stone-like hardness, and the seat of sharp, pricking, or burning pains, soon ulcerates, and pours out a thin, sanious, and fetid fluid, highly irritating to the neighboring healthy surface. The edges of the sore are hard, steep, everted, or partially undermined, while the bottom is foul and slightly covered with spoiled lymph; occasionally the part has a worm-eaten appearance. However this may be, the ulcer is always intractable, and, going on steadily from bad to worse, is apt to be followed by the most serious consequences.

Keloid is another form of disease which is liable to appear upon cicatrices; this, as will be seen elsewhere, is a peculiar fibro-plastic growth, which often forms after burns and scalds, and which derives its name from the supposed resemblance which it bears, in its configuration, to a crab.

Finally, cicatrices sometimes manifest a remarkable disposition to contract, which often continues long after they have apparently attained their full development. This tendency is nowhere more conspicuous than in burns and scalds, where it is occasionally so great as to give rise to the most horrible deformity. Thus, a vicious scar may pinion the arm to the side, pull back the hand upon the wrist, and draw down the chin upon the chest. The new tissue, consequent upon the loss of

substance caused by salivation, generally contracts in such a manner as to produce firm adhesion of the jaws, sadly interfering with eating and mastication.

In order to prevent degeneration of a cicatrice, it should be protected, especially if it be large, for a long time against rude manipulation, pressure, friction, and irritating applications. If there be any tendency to undue contraction, measures should be promptly adopted to counteract it, otherwise it may lead to great deformity and impairment of function.

CHAPTER V.

TEXTURAL CHANGES.

Under this head may be described those organic changes which are effected in the substance of the organs and tissues, as the result either of inflammation or of defective nutrition, consequent upon lesion in the circulatory and nervous systems. The most important of these alterations of texture are softening, induration, transformations, hypertrophy, atrophy, contraction, and fistule.

SECT. I.—SOFTENING.

Inflammation not unfrequently passes into softening, or what the French pathologists have denominated ramollissement. The event is characterized by a loss of cohesion of the affected textures, varying in degree from the slightest change of the natural consistence to almost complete pulpifaction. All parts of the body are liable to this occurrence, but those which are most apt to suffer are the lungs, brain, spleen, liver, and heart, together with the mucous membrane of the stomach and bowels, the articular cartilages, and the spongy structure of the bones. The subcutaneous and inter-muscular areolar tissue is occasionally softened to a great extent in rapidly progressive forms of inflammation, particularly in diffuse erysipelas. The vessels, nerves, muscles, and tendons, the fibrous and serous membranes, the lymphatic and salivary glands, the kidneys, the thyroid body, uterus, ovaries, testes, and prostate rarely experience this alteration under any circumstances, however violent the attendant action.

Softening sometimes takes place rapidly, at other times slowly; hence the distinction into acute and chronic. In the former case the affected tissues may be almost completely deprived of their natural consistence within the space of a very few days. Thus, in acute pneumonia the lungs are often so much softened at the end of three or four days as to be incapable of resisting the slightest pressure of the finger. In the brain and spleen the loss of cohesion sometimes proceeds even more rapidly than in the lungs. Chronic softening is most common in the cerebral substance and in the mucous membrane of the ileum and colon, where it is generally a most insidious disease, often involving a large extent of tissue, and yet unaccompanied by any characteristic symptoms.

The true nature of softening has not been explained. We can hardly, however, divest ourselves of the idea that it is not a species of

molecular mortification, especially in its more advanced stages. Be this as it may, it is unquestionable that the loss of cohesion, under such circumstances, is entirely incompatible with the exercise of the functions of the part, or its restoration to health. Many of its smaller vessels are completely obliterated, while the remainder are so crippled and paralyzed as to be scarcely able to propel their contents. Changes not less conspicuous are observable in the proper parenchymatous structure, which not only loses its natural consistence, but also its natural color; its cells are infiltrated with serosity, or serosity, lymph, pus, and blood, and its minute texture is no longer distinguishable by the aid of the most powerful microscope. If this is not death, or a condition closely approximating to it, what can it be? In the milder forms of mollescence the structure may still retain some vitality, and may, consequently, be able, in time, to regain its original characters; or, what is more probable, may be rebuilt by plastic matter, after the manner of other broken-down and mutilated tissues, the first step in the process being the removal of the effete substance.

There is a species of softening which is intimately connected with, if not dependent upon, obliteration of the vessels of the affected structures, with a consequent deficiency of blood and an impairment of nutrition. It is most frequently met with in the brain and spinal cord of old persons, and is generally supposed, although, as I think, erroneously, to be of a non-inflammatory character. If this opinion were correct, it is not probable that we should find, as we always do in this disease, more or less effusion of serum, plasma, and even pus. Wherever these fluids are deposited they afford indubitable evidence of incited action; hence it would be folly to conclude that they could be poured out here without inflammation.

This event of inflammation is interesting chiefly in a pathological point of view; for, as it is met with almost exclusively in the internal organs, and presents no characteristic symptoms, it is evident that treatment holds out little prospect of relief. When the true nature of the lesion is suspected, the proper remedies, in the acute form, will be such as are calculated to reduce inflammatory action and favor the removal of deposits; in the chronic variety a mildly alterative course, with tonics, embracing cod-liver oil, quinine, and iron, is indicated.

SECT. II.—INDURATION.

It has already been seen that a deposit of lymph, plasma, or plastic matter is common to nearly all inflammations, whatever may be their cause, site, or degree. When occurring upon the free surfaces of the organs, it usually presents itself in the form of a layer, which, escaping the influence of the absorbents, is ultimately converted into an analogous tissue, which often remains during the rest of the individual's life, being subject, in the meanwhile, to all the diseases and accidents incident to the pre-existing structures. When the deposit takes place in the substance of the organs, it fills up their cells, interstices, or molecular spaces, and thus increases their consistence, as well as their

weight, the matter assuming the shape of the cavities in which it is lodged, and being liable, as in the former case, either to be absorbed or to become organized, according to the condition of the part and the vitality of the morbid product. A similar arrangement occurs when plasma is effused into the cellular tissue beneath the skin, among the muscles, and in other situations.

Induration is extremely common, and may occur in any organ and tissue of the body. It is most frequently met with, however, in the lungs, spleen, liver, thyroid gland, testicle, the lymphatic ganglions, the prostate gland, the mamma, ovaries, uterus, bones, and subcutaneous cellular structure.

Age exerts considerable influence upon the production of induration. In the great majority of the organs it may take place at any period of life, but in some, as in the thyroid gland, for example, it rarely occurs before the fourteenth year, while in the genital apparatus it is hardly ever observed until after puberty. Induration of the prostate gland, of the vessels, and of the brain and spinal cord is an affection of advanced life, as is also induration of the crystalline lens and its capsule.

The degree of induration varies from the slightest alteration of the natural consistence of the part to the solidity and density of concrete albumen, old cheese, fibro-cartilage, cartilage, or bone. Much, in this respect, will depend upon the nature of the affected tissue, and the date of the lesion, or the degree of change which the deposit upon which the induration depends may have undergone. The color of the affected part may be normal, or variously altered, according to the amount of its vascularity and the presence or absence of effused blood. Much diversity also exists in regard to its volume, although in most cases this is considerably augmented, and sometimes even quite enormously, the bulk many times exceeding that which is natural to the organ in health. The weight of the part, too, is usually increased, and there is commonly more dryness, with a marked loss of elasticity.

The period required for the production of induration ranges from a few hours to several days, weeks, or months, depending upon the nature of the exciting cause and of the affected structures. In the testicle it often occurs in a very marked degree in less than twenty-four hours, and at the end of forty-eight hours the organ may be so hard as to be entirely incompressible. The induration accompanying the development of tonsillitis, adenitis, furuncle, carbuncle, and erysipelas generally occurs with extraordinary rapidity; and the same thing is frequently witnessed in the cellular tissue around the joints, especially in inflammation of a gouty or rheumatic character. In pneumonitis the parenchymatous substance of the lungs is often extensively solidified within a few days from the commencement of the morbid action. On the other hand, the induration may proceed very slowly, as in goitre, in chronic arteritis, hepatitis, and splenitis, and in certain affections of the uterus and prostate gland, where months, if not years, may elapse before it attains its full development.

The effect of induration upon the tissues in which it occurs is of the most prejudicial character, sadly impairing their structure and func-

tions, and frequently leading to the worst results. Thus, when it affects both testicles it may become a cause of impotence; in the liver it may interfere with the secretion of bile; and in the lung it may produce death by offering a mechanical obstruction to the ingress of the air. In the arteries induration is frequently followed by rupture of their coats, leading to aneurism; while in the cellular tissue around the joints it always impedes the exercise of the articular surfaces.

The immediate cause of induration is a deposit of plastic matter into the cells of the affected structures, which it thus obliterates while it condenses the adjoining substance, and so renders it unfit, either temporarily or permanently, for the proper exercise of its functions. The fluid is generally associated with more or less serum, and not unfrequently also with pus, and even pure blood. When the circumstances under which it is deposited are favorable, it soon becomes organized, and may finally be converted into an analogous tissue, which often retains its parasitic connection during the remainder of life, although in most cases it ultimately disappears.

In the treatment of induration the leading object is to excite the absorbent vessels so as to induce them to remove the deposits upon the presence of which the lesion depends. It need hardly be said that the sooner this is done the better. The longer we wait, the greater will be the danger of a permanent change of structure, or, when the organ is one of great importance to life, of the death of the patient. When the deposit is recent, and action still high, our reliance is mainly upon the vigorous employment of antiphlogistics, such as bleeding, purging, and diaphoretics, with antimonials, light diet, and perfect rest in the recumbent posture. Inflammation having thus been moderated, the induration, already greatly reduced by the previous measures, may usually be promptly disposed of by alterative doses of mercury, carried, perhaps, to slight ptyalism; and, where the part is accessible, by sorbefacient liniments, embrocations, and unguents, aided by pressure with the bandage. In the more chronic forms of the affection the different preparations of iodine must be brought in play, particularly Lugol's solution, Donovan's liquor, and the various forms of mercury, as the bichloride and biniodide; along with the topical applications just mentioned, if the induration be external. Friction and the cold douche will also prove serviceable under such circumstances.

SECT. III.—TRANSFORMATIONS.

The human body is in a state of constant mutation, of decay and renovation, commencing before birth, and continuing down to the last moments of existence. The Wolffian bodies and the gubernaculum of the testicle disappear during intra-uterine life; the thymus gland is gradually effaced during childhood; the arteries ossify in elderly persons; and at every period of life various states of the system, depending upon disease or accident, arise, in which there is a strong tendency to the deposition of oil globules, or the transformation of different organs and tissues into fatty matter.

The most important of these changes, surgically considered, are the cellular, mucous, cutaneous, fibrous, calcareous, and fatty; they are all connected with defective vitality, and with atrophy of some, if not all, of the constituent elements of the affected structures.

The cellular transformation is met with chiefly in parts that have been rendered useless, either from the natural cessation of their functions, or in consequence of accidental circumstances. Thus, the thymus gland, which is evidently connected with some important office in the fœtus, gradually decays during childhood, being converted into shreddy cellular substance, of which hardly a trace remains after the thirtieth year. The gubernaculum undergoes a similar change; the gall-bladder, occluded by biliary concretions, is occasionally completely transformed into this tissue; and the cellular adhesions so often seen between the costal and pulmonary pleuræ, consequent upon the degeneration of old adventitious membranes, are familiar to every pathologist. Various ligaments, especially the capsular, sometimes degenerate in this way; the metamorphosis is most marked in young subjects affected with unreduced dislocations of the hip and shoulder.

When skin is inverted for any length of time into one of the natural outlets of the body, as, for instance, the anal, it gradually undergoes a species of metamorphosis into mucous membrane. The first indication of the change is a softened condition of the cuticle and the disappearance of the hair; the epidermis scaling off, the surface beneath assumes a reddish, velvety aspect, becomes extremely vascular, and soon begins to secrete a thin, ropy, whitish fluid, not unlike mucus.

A change from mucous membrane to skin is sometimes observed, although the occurrence is uncommon. It is noticed chiefly in prolapse of the rectum, vagina, and uterus, the mucous investment of which, from long exposure to the atmosphere, becomes dry, rough, and insensible, and is ultimately converted into a tissue bearing a more close resemblance to the cutaneous than the mucous. The transformation, however, as in the case of the skin, is at best extremely imperfect, and it remains to be shown whether, in either instance, the old structures are so completely deprived of their identity as to justify the idea of a genuine transformation.

The *fibrous* transformation is most commonly met with in those parts of the body that have been deprived, either accidentally or otherwise, of their natural functions. Thus, in an artery that has been tied for the cure of aneurism or the arrest of hemorrhage the portion of the vessel included between the ligature and the first large collateral branch is gradually converted into a solid cylinder, which, in its turn, is changed into a dense, fibrous structure, in which it is impossible to discern any trace whatever of the primitive tissues. Ligaments, serous membrane, and adventitious textures occasionally undergo similar changes. The cornea, in the withered and atrophied eye, the victim of destructive inflammation, seems, at times, to be almost completely transformed into a substance bearing the closest resemblance to the sclerotica, one of the best examples of the fibrous tissue. In some of these cases, as in that just mentioned, the change is accompanied by a deposit of oil globules. The whitish opaque bodies, so frequently

observed in the coats of the spleen, in the placenta, and in the arteries of elderly subjects, are apparently essentially composed of fibrous substance, although in their outward characters they strikingly resemble fibro-cartilage.

The *calcareous* degeneration is most common in the arteries, but is also occasionally seen in other parts of the body, as in fibrous tumors, especially those of the uterus, in the articular cartilages, and in the concretions sometimes found in the larger joints, particularly that of the knee. In the arteries it generally begins in the form of little opaque patches, in the cellular substance between the inner and middle tunics, which, as they advance in age, assume a firm, solid consistence, and ultimately convert the vessels into rigid earthy cylinders. The deposit—for such is its nature, rather than a genuine degeneration—was formerly supposed to be of an osseous character, but recent researches have shown it to be altogether different, both in its chemical and physical properties. In the more matured specimens it is essentially composed of carbonate and phosphate of lime, in union with a minute portion of albumen; in recent cases, on the contrary, the animal matter exists in much greater quantity. It differs still further from bone in having no areolar structure, and in being destitute of vital properties. In fibrous tumors of the uterus large calcareous masses, weighing several pounds, are occasionally found.

The *fatty* degeneration, if not the most common of all, is the most universally distributed, since there is hardly any organ or tissue of the body in which, under favorable circumstances, it may not occur. Recent observation has demonstrated that it may take place in the lungs, in cartilage, in bone, the placenta, the cornea, and the crystalline lens. It is also met with in plastic exudations, tubercles, cancerous growths, and even, it is supposed, in pus globules. It has long been known to be of frequent occurrence in the muscles, and within the last fifteen years its presence has often been detected in the coats of the arteries, in connection with the atheromatous deposit. Thus it will be perceived that the fatty degeneration may take place both in natural and in adventitious formations; in the hard as well as in the soft, in the most humble as well as the most exalted in point of organization and life-power. Of all the various structures, however, which are liable to suffer from this lesion, the liver and arteries are probably most frequently affected. The former may undergo the fatty degeneration at any period of life, even in young children, and is a very common consequence of habitual alcoholic stimulation; the latter, on the contrary, is usually restricted to elderly subjects. The senile arc of the cornea is most common in advanced life, and is supposed by some recent observers, amongst others by Mr. Canton, to be almost always coincident with fatty degeneration of the heart and other organs. Fatty degeneration of the muscles occurs both in the voluntary and involuntary classes, although it is by no means so common in the latter as in the former.

The fat in this degeneration occurs occasionally in a free state, in the form of oil globules, cholesterine, and amorphous fragments, and is then essentially a deposit occupying the intercellular structure of

the tissues. Such a superaddition of fat is often observed in the liver, arteries, brain, and pancreas. On the other hand, there is no doubt that the transformation is sometimes real, being the same in principle as the fibrous or calcareous; that is, the affected tissues are broken down, and converted into fatty matter, or, to express the idea more accurately, replaced by oil.

An organ that has undergone the fatty degeneration will generally be a few shades lighter than in the natural state, and diminished rather than increased in consistence, easily torn, greasy to the touch, and of lighter specific gravity than in health. The amount of oil which it contains often ranges from one-third to one-half of its own weight.

What is the essential cause of the fatty degeneration? In some cases it would seem to be connected with general hypertrophy of the adipose tissue, and, consequently, to be owing to a mere redundancy of oily matter dependent upon the use of an inordinate quantity of hydro-carburetted food, and imperfect assimilative power. In the liver of some of the inferior animals the fatty degeneration can often be produced at will, simply by subjecting them to rest, and constantly cramming the stomach with food, which, by creating obstruction in the portal circle, probably induces congestion and inflammation of the hepatic tissues, which thus favor the deposition of oily matter. The fatty transformation of the liver of drunkards is doubtless occasioned in a similar manner. In other cases the lesion appears to be essentially due to a want of exercise of the affected parts, conjoined with deficient nervous supply, as is so often witnessed in the muscles of the leg in paralysis of the inferior extremity. Under such circumstances, especially when the case is of long standing, the muscles generally assume a pale, yellowish, or brownish aspect, are remarkably soft and flaccid, and yield a clear oily fluid on pressure, their fibres, however, remaining perfectly distinct.

It is still a mooted question whether the fatty matter, in this transformation, be deposited directly from the blood, or whether it be the product of some chemical change in the affected tissues, or in these tissues and other consentaneous exudations. My own belief is that it is generally, if not invariably, derived from the former source; and my reason for this opinion is simply this, that the transformation in question, when at all extensive, is nearly always associated with defective vital power of the diseased textures, along with impaired assimilative action, and with a redundancy of the protein principles of the blood; circumstances eminently propitious to the formation and deposition of fatty matter. Besides, cases have recently been observed of fatty degeneration of the heart and other viscera in which oil existed in the blood. On the other hand, the researches of Quain, Bennett, and others go to prove that the change may be altogether the result of a chemical transformation, these pathologists having found that healthy muscular fibre may be rendered fatty artificially, simply by digesting it for several weeks in water.

Of the treatment of the fatty transformation the present state of the science does not enable us to offer any satisfactory account. The whole subject, in fact, is shrouded in mystery, and it would therefore be

premature to attempt any discussion of it. When the patient's habits are at fault, they must of course be corrected; alcoholic stimulation must be abandoned, the diet must be changed, and a system of exercise must be instituted, to improve the state of the blood and the assimilative powers. Local treatment should not be neglected when the degeneration is suspected to be going on externally, as when the muscles of a limb begin to waste in case of paralysis, disease, or injury.

SECT. IV.—HYPERTROPHY.

The word hypertrophy is employed to designate the increased size and weight which an organ acquires in consequence of an augmentation of its nutrition or the deposit of plastic, organizable matter into its interstices. Its use was originally restricted to those preternatural enlargements which are so frequently met with in the heart and thyroid gland; but modern observation has shown that it is applicable to all organs and tissues characterized by an unusual development of their substance.

Hypertrophy may be general or local, and the latter may either occupy an entire organ or be limited to particular portions of it, or even to some of its component elements. It may exist alone or in association with other lesions, and is liable to occur at all periods of life; sometimes, as in the thymus gland and capillary vessels, apparently even before birth. No organ or structure is probably entirely exempt from it; but among those which are most frequently affected may be specified the lymphatic ganglions, the mamma, thyroid gland, spleen, liver, heart, prostate gland, tonsils, bones, vessels, adipose tissue, and skin. The best example of hypertrophy of the cutaneous textures is elephantiasis, in which the increase of weight and bulk is sometimes enormous.

The causes of hypertrophy are, first, inordinate exercise of an organ; secondly, mechanical obstruction; and, thirdly, chronic inflammation.

The most simple way, apparently, in which hypertrophy of an organ occurs is from an increase of its functional activity. Examples of this variety of the affection are found in various textures of the body, particularly in the muscles, lungs, and kidneys. In every part of the frame, the muscles are proportionate, in size and structure, to the efforts required from them; and it is a law of nature that, whenever they are frequently called into action, their fibres become considerably augmented in thickness, and capable, consequently, of much greater exertion. Thus the blacksmith, who constantly uses his arms in striking with his hammer, has much larger and stronger muscles than the dancing-master, who merely employs his legs. The same is true with regard to the lungs and kidneys. When one of these organs is imperfectly developed, compressed by effused fluid, or destroyed by some morbid growth, the other is sure to become preternaturally expanded, thereby compensating for the deficiency. There are certain viscera which are subject to temporary hypertrophy. Of this description are the uterus and mammary gland. During pregnancy and

lactation these organs increase very much in bulk, but again diminish soon after parturition and weaning.

Hypertrophy may be caused, secondly, by some mechanical impediment interfering with the due performance of the functions of an organ. This is frequently seen in the heart, where, in consequence of disease of the valves, preventing the easy passage of the blood, the viscus is obliged to undergo increased action, and so becomes more or less enlarged. In the muscular fibres of the stomach, the same change is often witnessed from obstruction at the pylorus, and in those of the urinary bladder, from stricture of the urethra, or hypertrophy of the prostate gland.

Hypertrophy from chronic irritation is of frequent occurrence, and is met with under a great variety of circumstances. Some of the best examples of this species of hypertrophy are seen in the lymphatic ganglions of the groin from chronic irritation of the head of the penis, of those of the mesentery from ulceration of the ileum, and of those of the bronchiæ from disease of the lungs. Enlargement of the liver and spleen, sometimes of enormous size, is unquestionably due to a similar cause. In chronic dysentery, not only the mucous and submucous cellular textures become hypertrophied, but the affection often extends to the muscular tunic, which occasionally attains an extraordinary degree of development. The follicles and villosities, which, in the healthy state, are hardly perceptible to the naked eye, are also rendered extremely prominent, the former being sometimes of the size of a mustard-seed, the latter more than a line in length. A similar development is frequently observed in the coats of the urinary bladder, in consequence of chronic inflammation.

Encysted tumors of the skin, mucous membranes, ovaries, and some other parts of the body, are evidently mere enlargements of the glands, cysts, and cells which naturally exist in these structures in consequence of chronic irritation or inflammation. The manner in which some of these tumors are formed is easily understood. Thus, in the skin-follicle, the first step in the development of the morbid growth is an obstruction of its orifice, thereby interfering with the evacuation of its natural secretion. This being retained, becomes materially altered in its properties, at the same time that it presses everywhere upon its sides; thus two sources of irritation are set up—altered and retained secretion and constant pressure—under the influence of which the little follicle often expands into a considerable-sized tumor. The mucous tumor is formed in the same manner. The enormous ovarian growths, so often seen in elderly women, are frequently, if not generally, mere enlargements of the so-called Graafian vesicles consequent upon chronic disease.

The color of the affected organ varies much in different cases and under different circumstances. In general, it is very much heightened, especially when the hypertrophy is wholly physiological; on the other hand, it is occasionally greatly diminished; and instances are often observed where it is apparently quite natural. The consistence may likewise be normal, diminished, or increased. These three conditions do not, however, occur with equal frequency. An increase of density

is by far the most common, and is particularly conspicuous in hypertrophy of the heart, mammary gland, the muscular fibres of the stomach and colon, the lymphatic ganglions, cellular tissue, bones, liver, spleen, and kidneys. A diminution of consistence is extremely rare, and cannot be viewed as a necessary consequence of the lesion.

An increase of weight of the affected organ follows, as a necessary consequence, in all cases where the lesion is not conjoined with atrophy. An augmentation of volume is by no means constant. Thus, in hypertrophy of the heart and bladder, there may be great development of the muscular fibres, with marked diminution of the size of their cavities. A change of form always arises when the hypertrophy is partially circumscribed, or limited to a particular point, as in the bones, skin, heart, bronchial tubes, and bloodvessels.

Hypertrophy essentially consists in an augmentation of the nutritive function. When in a state of unusual activity, the quantity of blood which an organ receives is considerably increased, in consequence of which it assumes a deeper color than one that is less exercised, at the same time that it augments somewhat in density; its elementary particles are increased in number, or such as already exist are augmented in size. It is in this manner that the alteration under consideration is brought about. In that variety of it which results from chronic irritation, it is not unlikely that there is often superadded to the alteration just mentioned a deposit of new substance in the spaces of the connecting cellular tissue, leading thus to a real change of structure. The effects of hypertrophy on surrounding parts will be pointed out in connection with the different organs and textures of the body.

In regard to the treatment of hypertrophy, no definite rules can be laid down, as it must be regulated, in great degree, by the nature of the exciting cause, which should, therefore, always be a prominent object of inquiry. Much benefit may, in general, be anticipated from the steady and persistent use of sorbefacients, locally and constitutionally applied, such as iodine, blisters, compression, mercury, iodide of potassium, and tartrate of antimony and potassa, aided by purgatives and attention to diet. In some cases, nothing short of the removal, partial or complete, of the affected organ will hold out any prospect of relief.

SECT. V.—ATROPHY.

Atrophy is the reverse of hypertrophy, consisting in a wasting of the substance of an organ, with a diminution of its weight and bulk. Occurring at all periods of life and in both sexes, it may affect a whole organ, or it may be limited to a part of an organ, or to some of its constituent elements.

Remarkable examples of general atrophy are occasionally met with, but such an occurrence is of no special surgical interest, and does not therefore demand any particular notice here. Cases of this kind are sometimes apparently of a congenital character; at other times they are the result of disease, and are either curable or otherwise, according to their extent and the nature of their exciting causes.

Local atrophy may be produced by a variety of causes, of which the principal are, first, cessation of the natural function of an organ; secondly, loss of nervous influence; thirdly, deficient supply of blood, or nutritive matter; and lastly, inflammatory irritation.

It appears to be a law of the animal economy that an organ, when of no further use, gradually falls into a state of decay. Of this class of structures are the umbilical vesicle and the pupillary membrane of the fœtus, the former of which, after having subserved the purpose of its formation, disappears at the close of the third month, the latter between the seventh and eighth. The kidneys are preceded in the embryo by two jelly-like bodies, to which the term Wolffian has been applied; these bodies, which exist not only in the mammalia, but likewise in birds and amphibia, acquire their greatest bulk about the middle of utero-gestation, after which they gradually diminish by absorption, and at length entirely disappear. The gubernaculum, which is visible in the tenth week of embryotic life, is a thin membranous process, which guides the testicle to the internal ring, and is finally converted into cellular substance. These are instances of atrophy from the cessation of the functions of an organ in the fœtus. After birth changes not less remarkable are to be observed; such, for example, as the wasting of the thyroid body, the supra-renal capsules, and the thymus gland. From the same cause the alveolar processes of the jaws disappear after the removal of the teeth. The ovaries shrink after the decline of the menses; and, in conformity with a similar law, the testicles often diminish remarkably in size in monks, who lead a life of celibacy, in the strict observance of their vows.

Atrophy may result, secondly, from a diminution of nervous influence; a circumstance not surprising when it is recollected how much the action of the capillaries is under the control of the cerebro-spinal axis. Whole limbs sometimes waste from this cause; in other cases the lesion is more limited, and implies a very partial disorder of the nerves. It has been observed that atrophy, when caused by disease of the brain, occurs much more slowly than when it is occasioned by an affection of the nerves of the part. The reason of this difference is not very obvious.

This variety of atrophy is very common in young children during dentition, from the sudden and often total suspension of the nervous influence, constituting a species of local paralysis, which often terminates in complete wasting of the affected parts. It is most frequently observed in the lower extremities, sometimes in one, and at other times in both; but it also occurs, though much less frequently, in the upper extremities, particularly in the deltoid muscle, which is occasionally transformed into a pale, flabby membranous layer, not more than a few lines in thickness.

Remarkable examples of atrophy of the upper extremities occasionally occur from pressure of the head of the humerus on the axillary plexus of nerves, thereby interrupting the nervous influx. When such an accident takes place in very young subjects, and is permitted to remain unrelieved, the growth of the limb, if not positively arrested, is imperfectly executed, and the consequence is that not only the

muscles, but even the bones become singularly stunted in their development, their shafts being very thin, and their muscular prominences unnaturally small and indistinct.

It is probable that a mere perversion of the nervous function of an organ is capable of producing atrophy. In neuralgia of the testicle, that organ is sometimes remarkably diminished both in size and consistence, not so much, apparently, from an actual loss of nervous influx, as from a change in its character. What corroborates this view is the fact that the testicle, while the wasting process is in operation, is often so exquisitely sensitive as to be intolerant of the slightest manipulation.

The effects of a deficient supply of blood in producing atrophy are well known, inasmuch as cases of this description are sufficiently frequent in practice to make them an object of special interest. When any part is deprived of the usual quantity of this fluid, it very soon becomes enfeebled, its substance is rendered pale and flabby, and it at last loses the power of action, although every other condition for its performance may remain unimpaired. Thus, the testicle wastes after tying the spermatic artery; and, for the same reason, the muscles of the lower extremity occasionally shrink after securing the principal vascular trunk of the thigh. Atrophy of the heart is sometimes produced by ossification of the coronary vessels, and a case is recorded in which the spleen, from the obstructed condition of its artery, was not larger than a filbert. In old age, many of the capillaries are obliterated; and it is not improbable that to this circumstance is owing that diminution of the size of the organs which constitutes senile atrophy. To the same cause is to be attributed the wasting of the lung and heart, from the accumulation of fluids in the pleuritic and pericardiac cavities.

Atrophy attendant upon mere want of exercise is no doubt essentially due to deficient nervous and vascular supply; in conformity with the law, mentioned under the head of hypertrophy, that the development of an organ is usually in proportion to the amount of its use. The wasted and attenuated condition of the legs in club-foot and other affections depriving the muscles of their functions, or interfering with their proper exercise, is probably owing entirely to this cause, as is shown by the fact that, when the disability is removed, the individual gradually recovers the use of his limbs, the calves often becoming strong and plump, as if there never had been any arrest of growth. The only, or chief, exception to this is where the muscles have undergone the fatty degeneration, in which case they never regain their original development, but always remain weak and puny.

Atrophy from inflammation is very common. A good example of this species of wasting is seen in what occurs in the gall-bladder from the presence of biliary concretions, and which is sometimes followed by complete wasting of this organ, its coats being converted into a thin fibrous mass, having hardly any trace of the original reservoir. Hepatitis often gives rise to atrophy of the parenchymatous structure of the liver, and orchitis, especially when supervening on mumps, is not unfrequently succeeded by impotence. How the lesion, in these and other cases, is produced, is not easily determined. It is probable that

the inflammatory deposits may so choke up the capillary vessels of the parts as to deprive them of their customary and necessary supply of nutritive material; or, if this conjecture be untenable, that the pressure exerted by these effusions causes the absorption of some of the anatomical elements of the affected structures, thus reducing them, as it were, to their primitive condition.

Atrophied structures are prone to undergo the fatty transformation, and it is not improbable that this transformation itself occasionally acts as an exciting cause of the wasting process. However this may be, it is certain that the two lesions are sometimes so intimately associated as to render it impossible to determine which preceded the other, or what part they played as cause and effect.

The change of color experienced by an atrophied organ is necessarily greatly influenced by the natural complexion of the part, but does not possess any special surgical interest. The weight of the affected structures is generally considerably diminished, but their bulk often remains unaltered, and it is not uncommon to meet with cases where it is even greater than natural.

The treatment of atrophy, occurring in an external or accessible part of the body, as a muscle, resolves itself into the use of the warm and cold douche, frictions, either dry or through the medium of stimulating embrocations, and the application of electricity, as described under the head of wasting palsy. The general health must be amended, strychnine and tonics being given when there is marked evidence of debility. The affected part must be gradually and steadily exercised, or, as it were, re-educated; the influence of a strong will frequently directed upon it being often of essential service in rousing its latent faculties.

SECT. VI.—CONTRACTION AND OBLITERATION.

By the term contraction is meant the diminution of a canal, tube, or passage to an extent incompatible with the due performance of its functions. It is strictly synonymous with the term stricture, the signification of which is so well understood by the surgeon. The lesion is liable to occur in various degrees, from the slightest possible change in the size of a canal to the complete obliteration of its caliber.

The chief interest of this subject, surgically considered, relates to the contractions that occur in the mucous canals, or excretory ducts, as they are called, and in the bloodvessels, in both of which the lesion is frequently productive of the most disastrous consequences; attended, in the former, by retention of the secretions of these tubes and of the contents of the reservoirs with which they communicate, and in the latter by an impediment to the circulation which, in one case, may lead to atrophy, and, in another, to softening, ulceration, or gangrene.

Contractions of the mucous passages, to which the ensuing remarks are more particularly designed to apply, are deserving of great attention, both from the frequency of their occurrence, and from the great suffering which they so often entail upon those who are the subjects of them. They are met with in nearly every mucous outlet of the

body, but are more common in the male urethra and in the nasal canal than anywhere else. Doubtless stricture often exists in the smaller excretory ducts, as those of the prostate and salivary glands, without our knowledge, or without awakening any serious functional disturbance; but in the larger passages the slightest coarctation is generally a source of more or less annoyance, if not of great pain and inconvenience.

The causes under whose influence contraction is developed are mainly two; first, inflammation with plastic deposit, and secondly, mechanical compression. Of these the first is by far the more common.

The inflammation giving rise to this lesion may be either acute or chronic; in the former case generally doing its work rapidly, with bold and well-marked symptoms; in the latter, on the contrary, the injury is often inflicted in a slow and stealthy manner, without perhaps exciting any suspicion on the part of the patient of what is impending. The plastic matter, the real cause of the contraction, is generally deposited into the submucous areolar tissue, either exclusively, or partly there and partly into the interstices of the mucous membrane itself. However this may be, it soon becomes organized, and is ultimately transformed into cellulo-fibrous or fibro-cartilaginous tissue, which, gradually contracting upon itself and upon the neighboring structures, thus diminishes, in a proportionate degree, the caliber of the tube in which it is situated. It is in this manner that all organic strictures, properly so termed, of the mucous outlets of the body are formed.

The second cause of contraction is, as already stated, of a purely mechanical character, although in most cases, if not in all, the lesion is attended with inflammation and plastic deposit, secondary, however, in their character. It is thus that stricture of the nasal canal may be produced by the pressure of a tumor in the sinus of the upper jaw; of the bronchia, by the pressure of an aortic aneurism; and of the Fallopian tubes, the biliary ducts, and ureters, by the pressure of an enlarged viscus or morbid growth in their immediate vicinity. The same cause often induces constriction and even complete obliteration of the bloodvessels. A tumor, compressing the aorta, has been known to give rise to permanent closure of that vessel as effectually as if it had been surrounded by a ligature.

The extent of the contraction varies, both in length and in diameter, in such a manner as to render it impossible to specify it in a general manner. In some cases, it may not exceed the fraction of a line, while in others it may involve the whole length of the affected tube.

The effects of such a lesion upon the parts concerned are often extremely distressing. Thus, in the urethra, the obstruction is attended with difficulty of micturition; in the nasal canal, with impediment to the passage of the tears into the nose; and in the œsophagus, with difficulty of deglutition.

The prognosis, in ordinary cases, is not at all serious, as the obstruction generally admits of relief, except when it has been induced by the compression of some internal tumor or an enlarged viscus, in which case it will almost necessarily be irremediable.

The treatment of the inflammatory form of contraction must be conducted according to the general principles laid down in the chapter on lymphization; by antiphlogistic remedies in the earlier stages of the disease, and afterwards by alterants, rest, light diet, purgatives, leeches, and a regular, systematic course of dilatation by means of bougies, either alone or aided by incision, scarification, or free division of the affected structures. Great care must be taken, in the employment of dilatation, to conduct it in the most gentle and cautious manner, the object being to excite the absorbent vessels, while the capillaries are, if possible, kept in a perfectly passive condition. In this way, we get rid, in time, of the effused matter, upon the presence of which the constriction essentially depends, without provoking any further deposition.

SECT. VII.—FISTULE.

A fistule is a narrow track, straight or tortuous, of variable depth, having generally two distinct orifices, lined by an adventitious membrane, and bathed with a thin, gleety fluid, intermixed with the natural contents of the part, organ, canal, or cavity affected. The disease, which is always of a consecutive nature, occurs in different regions of the body, and is developed under the influence of various causes.

Although the abnormal track has usually two openings, one of which is superficial and the other deep-seated, yet this is by no means constantly the case. Hence the distinction of fistules into complete and partial. The terms recent and old, often used by writers, refer merely to the duration of the disease.

The lesion may occur in almost any situation, but originates most frequently about the anus, perineum, face, groin, and mammary gland. Fistule of the neck, thoracic cavity, the biliary apparatus, the stomach, colon, and small bowel, kidney, pancreas, and urinary bladder, is comparatively rare. It takes place in both sexes and at every period of life; but children and young persons suffer much less frequently than the old and middle-aged.

The nomenclature of fistule is quite extensive. The names are derived either from the parts in which the abnormal passage is situated, as anal, perineal, broncho-pleural, and recto-vaginal, or from the nature of the discharge, as salivary, urinary, and stercoraceous.

Fistules vary much in their extent. The longest tracks occur along the spinal column in connection with psoas abscess. In this affection, the matter generally escapes in the groin, just above Poupart's ligament, in the upper part of the thigh, or, lastly, in the ileo-lumbar region, the channel which is thus established varying in length from six to twelve inches, and being always lined by a well-organized, adventitious membrane. Passages of considerable length are sometimes met with in the internal organs, as between the kidney and lung, between one coil of intestine and another, or between the urinary bladder and the cutaneous surface. In other situations, on the contrary, the track is remarkably short, being hardly two or three lines from the surface, or from the cavity with which it communicates.

The diameter of these abnormal tracks is also very variable. Sometimes they are so small as scarcely to admit the finest bristle; while at other times they are sufficiently capacious to receive a goose-quill or the end of the finger. The narrowest tracks usually occur in the lachrymal passages, salivary glands, anus, and perineum. It is not often that the fistule is of the same uniform diameter throughout; on the contrary, it is almost always larger at one point than at another.

The external orifice, generally of a rounded or oval shape, may be so narrow, on the one hand, as to be hardly perceptible, or, on the other, so large as to admit the end of a probe, a goose-quill, or a finger. It may have sharp and well defined margins; be surrounded by a soft, spongy, florid rim; or, be depressed, inverted, or infundibuliform. The number of external orifices varies in different cases, from one to as many as six or a dozen; when it is very considerable, the affected surface commonly presents a cribriform appearance.

The internal orifice may be of the same size as the external, or it may be smaller or larger. In its shape it is usually irregularly rounded, and it is seldom that it is found multiple, even when the number of external openings is considerable.

Although the direction of the passage may be perfectly straight, yet, in general, it is more or less flexuous, serpentine, oblique, or winding. Occasionally it forms nearly a right angle with the surface on which it opens. When several tracks exist, they often run together, and open by one common orifice upon the reservoir with which they communicate.

A fistule, in its recent state, is simply a raw surface, secreting purulent matter. It is, in fact, an ulcer, an open sore, a solution of continuity, which must undergo a process of reparation before it can be justly entitled to its distinctive appellation. The track, however, soon becomes smooth, and is speedily coated with an adventitious membrane, varying in thickness from a mere film to half a line, a line, or even the sixth of an inch. This new layer, at first soft and easily detached, gradually augments in density, and is at length inseparably united to the parts which it serves to line. Its color, like its consistence, is very much influenced by its age, and by the nature of the secretion or excretion which passes over it. At an early period it is red, pink, or rose; in cases of long standing, on the contrary, it is either white, gray, or slightly bluish. The free surface of the membrane is smooth and polished; or it is rough, mammillated, or studded with villi of various shapes and sizes. The other surface is attached by means of short cellular substance to the parts upon which it lies. Bands of lymph sometimes extend from one side of the abnormal channel to the other, very much as in the bridle stricture of the urethra; but this is rare.

The membrane here described is formed out of the plastic lymph of the blood, and is of the same nature as the pyogenic membrane of a chronic abscess. Around the anus, in the perineum, and in some other regions, it bears no little resemblance to the mucous tissue, but differs from it in having no follicles and no distinct epithelial layer. It is liberally supplied with vessels, nerves, and, probably, also with

absorbents, is the seat of a constant secretion of gleety or other matter, and is liable, like all new textures, to inflammation and its consequences. In ancient cases it occasionally acquires a dense, fibrous, or fibro-cartilaginous consistence.

The nature of the discharge in this disease varies with the situation of the abnormal passage. In general, it is thin and gleety, as in chronic gonorrhœa, and mingled with the natural secretions, or excretions of the reservoir with which the fistule communicates. When, however, the lining membrane labors under inflammatory irritation, the discharge is either entirely suspended, or it is bloody, purulent, or mucopurulent.

The parts in which the abnormal track is situated are variously affected. In some cases they are nearly natural; but in general they are firm and callous, from the effusion and organization of plastic lymph, which, being often present in large quantity, completely obliterates the meshes of the connecting cellular tissue.

Finally, the causes which give rise to fistules are either mechanical or vital. To the first class belong wounds, contusions, and lacerations; to the second, ulceration, gangrene, and abscesses. There is a variety of fistule which may be regarded as a remnant of embryotic organization. Its most frequent situation is the antero-lateral part of the neck. Like the ordinary fistule, it may terminate in a cul-de-sac, or it may have two orifices, of which the external is sometimes scarcely visible. The abnormal passage itself is usually very narrow, and seldom extends beyond two or three lines in depth.

The *treatment* of fistule must be regulated by circumstances. In recent cases, before the passage has become lined by an adventitious membrane, a cure will sometimes follow the use of stimulating injections, as a weak solution of nitrate of silver, sulphate of copper, tincture of iodine, or acetate of lead, repeated twice in the twenty-four hours; or by touching the parts lightly once a day, or once every other day, with the solid lunar caustic, or with the end of a probe dipped in a solution of the acid nitrate of mercury. Strict attention should be paid to cleanliness, and the parts should be maintained in a state of absolute rest. It is seldom, however, that a permanent cure can be affected in this way, especially if the fistule be of any extent, or situated where it is influenced by the contraction of muscular fibres, as, for example, when it involves the anus. The best plan, in fact, nearly always, is not to lose any time in experimenting with these remedies, but at once to lay open the abnormal passage in its entire length, so as to afford the parts an opportunity of healing from the bottom by the granulating process, a tent being interposed between the edges to prevent their re-adhesion. Occasionally a seton may be passed through the track, and be retained until it ulcerates out. In some forms of fistule, as in the vesico-vaginal and urethral, a very delicate operation is generally required in order to effect a cure, consisting in paring the margins of the opening and bringing them together by several points of suture.

The prudent practitioner is sometimes sorely perplexed in this disease as to the propriety of attempting a radical cure, or whether he

should interfere only so far as to palliate the patient's suffering. In general, it will be best to let each case be governed by its own rules. When the fistule has been of long standing, and has acted all along as a drain upon the system, serving perhaps to counteract some other affection, such as phthisis or a tendency to apoplexy, no operation should be practised, since it could hardly fail to provoke mischief. In fact, serious organic disease of any kind is a contra-indication to an operation. The only exception to this is where the fistule is a cause of excessive local distress, completely depriving the patient for days of sleep, appetite, and comfort. Under such circumstances the surgeon could hardly refuse his aid; but before doing this, he would be sure to open a new source of counter-irritation, in the form of an issue or seton, in some other and more eligible portion of the body, thus establishing a drain at least equal to that which he is about to suppress in order to afford temporary mitigation. In ordinary cases there is of course no reason for delay; the operation is promptly performed, and a rapid recovery is reasonably anticipated.

CHAPTER VI.

CONGENITAL MALFORMATIONS.

CONGENITAL malformations, surgically considered, constitute a subject of the deepest interest, both because they are of frequent occurrence, and because they generally require an extraordinary amount of knowledge and skill for their successful management. Presenting themselves under different forms, or characters, they exhibit every variety of grade, from the most simple departure from the normal standard to the most pitiable and disgusting deformity, well calculated to elicit the sympathy and aid of the considerate and humane surgeon. With a view to a more full appreciation of the nature of these malformations, they may conveniently be arranged under the following heads: 1st, deficiency of parts; 2dly, redundancy of parts; 3dly, displacements; 4thly, occlusions; 5thly, deviations of position; 6thly, adhesions of contiguous surfaces; 7thly, vascular tumors.

1st. The first class, consisting of a *deficiency* of parts, may be subdivided into two orders; the one comprehending fissures, or clefts, and the other an entire absence of certain structures, as a finger, hand, or ear.

The most common, and, in a surgical point of view, the most interesting, fissures are hare-lip, cleft palate, bifid uvula, extrophy of the bladder, epispadias, hypospadias, and bifid spine, together with extraordinary patency of the fontanelles. Of these malformations some admit of relief by operation, whereas others are hopelessly irremediable; at all events, every attempt hitherto made to cure them has either signally failed, or sooner or later destroyed the patient. The operation for hare-lip is of daily occurrence, and, when properly executed, rarely disappoints expectation; besides, if it fail, it admits of repetition. Staphyloraphy has also become a common procedure, being frequently, if not generally, crowned with success. Extrophy of the bladder, consisting in a deficiency of the anterior wall of that viscus and of its protrusion at the linea alba, has hitherto resisted every means directed for its relief. Epispadias and hypospadias are difficult of cure; and cleft of the vertebra, with protrusion of the envelopes of the spinal cord and of the cephalo-spinal liquid, is nearly always a fatal affection. The closure of these fissures is effected by paring their edges, and afterwards approximating them by suture, ultimate union being accomplished through the intervention of plastic matter. The tumor in bifid spine is emptied with the trocar, and then injected with some slightly stimulating fluid, with the hope of exciting obliterative inflammation. In general, the operation is speedily followed by convulsions, coma, and death.

In the second order of cases the deficiency consists in the absence of certain structures, as a finger, a hand, or even an entire arm. The genital organs suffer perhaps more frequently in this way than any other parts of the body. Thus it is by no means uncommon to find the vagina absent, or the vagina and uterus, or these organs along with the ovaries and Fallopian tubes. Sometimes the testes are wanting, or, if present, they exist only in a rudimentary form, perhaps hardly equalling the volume of an ordinary bean. The penis, too, may be absent; or, instead of being large and well grown, it may, at the age of puberty, be less than that of a child at the eighth or tenth year.

2dly. A congenital *redundancy* of structures is sometimes met with, consisting, chiefly, in hypertrophy of the integuments of various regions of the body, or in the addition of a supernumerary finger, toe, tooth, or ear. To the same category belong the anomalous divisions of certain arteries, as the brachial and femoral, high up in their respective limbs. A redundancy of skin and cellular substance is most common about the neck, hands, feet, and genital organs, as the prepuce and vulva, where the superfluous structures sometimes occur in large, pendulous masses. A supernumerary toe, thumb, or finger is no unusual occurrence; occasionally each hand and each foot are provided with such an appendage. I have seen one well-marked case of four ears; an increase of the natural number of teeth is not uncommon. In some of these cases the supernumerary organ is buried in the alveolar process of the jaw, where I have known it to be productive of such an amount of disease as to require a serious operation for its removal. Most of these malformations admit of cure by retrenchment with the knife, and the operation may generally be safely executed at an early age.

3dly. Congenital *displacements* occur in various parts of the body, but principally in the articulations and in the abdominal viscera. The joints that are most liable to this form of dislocation are the hip, shoulder, and wrist; but it has also, although very seldom, been met with in those of the jaw, clavicle, elbow, and knee. The deformity thus produced is often very great, and what aggravates the case is the circumstance that it rarely admits of relief, however skilfully and perseveringly it may be treated. The malformation, as will be shown elsewhere, probably begins at an early period of fœtal life, and goes on gradually increasing until it attains an irremediable stage.

The most common form of displacement of the abdominal viscera occurs in what is called congenital hernia, caused by a want of closure of the inguinal canal during the descent of the testis. The consequence is that, soon after the child has begun to breathe, the diaphragm, pressing the bowels against the walls of the abdomen, forces them down into the scrotum. The portion of tube thus displaced is generally a loop of small intestine, but now and then other organs are pushed down along with it. The most suitable remedy for such a defect is steady compression upon the neck of the hernia by means of a well-adjusted truss, which generally eventuates in an effusion of lymph, and the obliteration of the sac of the tumor.

4thly. Congenital *occlusion* may occur in any of the mucous outlets of the body, but is much more frequent at the anus and genital organs than anywhere else. Closure, properly so called, of the anus may be produced by a continuation of the integuments across from one buttock to the other; or it may depend upon the existence of a fold of mucous membrane situated just within the anus, an arrangement not unlike a hymen. In either case, relief may easily be effected by the knife, patency being afterwards maintained by the frequent insertion of the finger. The prepuce is sometimes completely impervious, or if an opening be present, it answers very imperfectly the purpose of an outlet for the urine. The vagina is occasionally imperforate, being closed by what is termed the hymen; and there is reason to believe that certain forms of sterility are due to occlusion of the uterus, or of the Fallopian tubes.

5thly. Congenital *deviations* of position are infrequent. The most interesting, in a surgical point of view, is the deformity of the nasal septum, which is sometimes so great as to interfere materially with the functions of the nose, one of the anterior nares being sometimes completely occluded by the projection of the partition towards the corresponding side. A simple operation, consisting in the removal of the incurvated portion of the septum, generally effectually relieves the difficulty.

There is occasionally a remarkable congenital incurvation of the penis, disqualifying the organ for the easy and full discharge of its functions. The defect is always associated with hypospadias, and consequent shortening, or imperfect development of the spongy structure of the urethra. An admirable operation for the cure of this deformity, devised by my colleague, Professor Pancoast, will be described in the chapter on the genital organs.

Deviation of position is often associated with permanent contraction or shortening of the muscles and tendons, as is seen in club-foot, wry-neck, and other analogous distortions. This class of lesions is one of great practical interest, having opened to the modern practitioner a wide field for the exercise of his ingenuity and skill, as well as of his patience. Taken in hand soon after birth, they may frequently be promptly remedied by the use of the most simple appliances, whereas under opposite circumstances the treatment will generally be very tedious, even if aided by the free division of the affected structures. The rectification of these malformations forms one of the most interesting chapters in the history of subcutaneous surgery, one of the great discoveries of modern times.

6thly. Congenital *adhesions* are sometimes observed, chiefly between the fingers and toes; more rarely between other parts, as the eyelids and the ball of the eye, the ear and the scalp. The uniting medium is generally merely a fold of common integument, the severance of which often effectually releases the parts from their restraint, and restores them to usefulness.

7thly. I may mention, finally, as another class of congenital affections, those peculiar vascular tumors known as *nevi*, or *mother's marks;* they occur in different regions of the body, especially the head and

face, and constitute an exceedingly interesting and important form of morbid growth. Their composition is variable; sometimes they are essentially composed of dilated and tortuous capillary veins, connected by areolar tissue; at other times they are made up mainly of enlarged and diseased capillary arteries; lastly, there is a third species which seems to partake of the character of both the others, the two sets of vessels being so intimately blended as to render it impossible to determine which predominates.

These vascular growths, however constituted, almost always begin in the substance of the skin, from which, as they augment in size, they gradually extend to the cellular tissue beneath; they are of a soft, spongy consistence, readily receding under pressure, and expanding under mental emotion. Their color is variable; the venous varieties being usually of a dark purple, and the arterial of a red scarlet hue. The latter are of a truly erectile character, and hence they commonly pulsate, heaving and throbbing synchronously with the contraction of the left ventricle of the heart. The growth of both varieties is generally steadily progressive, and the consequence is that they often acquire a considerable bulk.

Most of these morbid growths readily admit of cure, especially if timeously begun. This may be effected, 1st, by ligation; 2dly, by excision; and 3dly, by escharotics.

In regard to the causes of these various malformations, it would be entirely out of place to inquire into them here. My sole object has been to bring the subject briefly before the reader in its practical relations; any other information respecting it may readily be obtained by a reference to the many works specially devoted to such discussions. Some of these malformations are doubtless owing to an arrest of development, dependent upon a defective organization of the germ; others are probably caused by irritation of the nervous centres; while others, again, are perhaps due to faulty position of the fœtus in the uterus, or violence inflicted upon it during gestation.

CHAPTER VII.

TUMORS, OR MORBID GROWTHS.

SECT. I.—GENERAL OBSERVATIONS.

WHAT is a tumor? The best definition that, in my judgment, can be given of it is that it is an enlargement of a part, structure, or organ, produced by abnormal deposit. This abnormal deposit may be an entirely new formation, or it may be merely a superaddition to the original one. It may, moreover, be benign or malignant; that is, it may simply incommodate by its situation, weight, and bulk, or it may, after a certain period, destroy not only the part in which it appears, but also the life of the patient. It may be stated, as a general law, that most of the benign tumors, or innocuous growths, are the result merely of some alteration in the function of the primitive tissues; many, indeed, are nothing but local hypertrophies, or enlargements produced by inflammatory deposits, supernutrition, or the retention of some normal secretion. On the other hand, malignant tumors are always caused by the deposit of a new substance which is either entirely distinct from the natural structures, or which bears but a very faint resemblance to them, in its physical, chemical, and vital relations. The only exception, perhaps, to this law is the hydatic tumor, which, although it is altogether foreign to the natural organization, is of a non-malignant character.

The number of malignant formations, so far as is at present known, is comparatively small, while the number of benign is very considerable. Occurring at nearly all periods of life, and in nearly all the organs and tissues of the body, they possess certain features in common with each other, which renders it necessary to study them in a general point of view. Such a proceeding is indispensable to a correct appreciation of the structure, diagnosis, and treatment of these affections. The principal topics to be considered, in connection with these circumstances, are, first, the physical properties of the morbid growth; secondly, its relations to the surrounding structures; and thirdly, its history.

1st. It would be difficult to point out a *situation* where tumors may not occur. With the exception of the tendons, fibrous membranes, cartilages, and bloodvessels, they are found in all parts of the body, and it would hardly be proper to affirm that even these structures are altogether exempt from them. As a general rule, it may be stated that malignant growths are most common in glandular organs, as the mamma, liver, and mucous follicles; in the cellulo-adipose tissue, as

in the case of melanosis; or in the peritoneum, stomach, bowel, and bones, as in that of colloid. Tubercular deposits occur almost everywhere; but, surgically considered, more frequently in the lymphatic glands than anywhere else. Epithelial cancer has a peculiar predilection for the cutaneous and mucous textures at the various outlets of the body. Benign tumors are most common in the skin, cellulo-adipose tissue, nose, uterus, and ovary. Hydatic formations are seen chiefly in the liver, breast, testicle, and bones.

Tumors affect various *forms*, depending not merely upon the nature and amount of resistance offered to their development, but also, in some degree, upon the original shape of the part wherein they originate. A sebaceous tumor is generally globular; a fatty one either flat or pendulous; a polypoid one pyriform, conical, or pediculated. Malignant growths are commonly distinguished by the irregularity of their surface, which is often lobulated, or marked off into ridges and depressions.

In their *volume*, tumors range, in every possible gradation, from that of a millet-seed, as in the little granule on the eyelid, to that of the patient's body, as in ovarian cysts and elephantiasis of the scrotum, those enormous masses which are sometimes absolutely more bulky and heavy than the subject in whom they are developed. Fatty, fibrous, and osseous growths occasionally acquire a large size, but they are almost the only ones of their class that do. Among the heterologous tumors, those which attain the greatest magnitude are the encephaloid and colloid; scirrhous, melanotic, and other formations of this description, being usually comparatively small.

In respect to their *consistence*, some tumors are soft, some solid, some semi-solid. Tumors containing serous fluid, as hygromatous cysts of the neck and of the ovary, are always soft and fluctuating, unless they are overlaid by a large quantity of solid substance, when they may partake of the latter character even more than of the former. Fibrous and osseous tumors are known by their great hardness, which is equal to that of the natural structures. Scirrhus is the most firm of the heteroclite tumors, its name being derived from that circumstance. Occasionally one portion of a tumor is soft, another hard, and a third, perhaps, semi-liquid. Ovarian growths exhibit these varieties of consistence more frequently, and in a more perplexing degree, than any other, whether benign or malignant.

The *color* of a tumor is generally a matter of secondary consideration, as it is seldom that the morbid growth is sufficiently exposed to admit of direct inspection, except in some of the mucous outlets. In the early stage of all formations of this kind that take place beneath the external surface of the body, there is usually an absence of discoloration, and it is only when the growth bears too heavily upon the skin, pushing it out in every direction, or when it manifests a disposition to ulcerate and evacuate its contents, that it causes the skin to be red, livid, or purple. In tumors of the nose, uterus, and anus, color often affords us great assistance in our discrimination of the case. A gelatinoid polyp can never be mistaken for a fibrous one, its complexion being always diagnostic of its character. It may be assumed,

as a general rule, that the lighter a tumor is externally the greater is the probability of its being benign, and conversely.

Mobility is an important quality in a tumor, its amount varying according to the nature of the affected organ and the degree of resistance offered by the surrounding parts. Some morbid growths are never movable, others always are, whatever may be their age, volume, or situation. A sebaceous tumor never contracts such firm adhesions as not to be susceptible of being pushed about; while an exostosis is always immovable from its very commencement. Most of these formations, whatever may be their character, contract adhesions to the surrounding tissues as they augment in age and volume, their pressure exciting inflammation and plastic deposits, which thus become the bond of union between the normal and abnormal structures.

Tumors are endowed with various degrees of *sensibility*, depending upon the peculiarity of their structure and the amount of compression exerted upon them by the parts in which they are developed. Most tumors, whether innocuous or malignant, are free from pain during their earlier stages; but, as they increase in size, they encroach upon the neighboring tissues in such a manner as to interfere with their movements, and thus seriously compress their nerves, whilst the latter, in their turn, more or less compress the nerves of the advancing mass. Occasionally the pain is characteristic, as, for example, in scirrhus of the mammary gland. Encysted tumors of the skin are usually entirely free from pain, or, if there be any pain, it is the result of accidental circumstances.

2dly. In regard to the *relations* which tumors bear to the surrounding structures, several circumstances deserve to be noticed. The first is the manner in which they are bound down, or inclosed in their habitation. Every tumor must necessarily have an appropriate residence, but, like a settler in a new country, it is seldom content with the spot originally assigned to it. On the contrary, soon lacking room, it is sure to encroach upon, fret, and worry the parts around it, which, as already seen, are not slow to resent the invasion. Mutual oppression and mutual discomfort are the result. The healthy structures successfully resist for a while the intrusion, but gradually they yield before the enlarging mass, which thus often converts the muscles into mere ribbons and the bones into mere shells. Function, too, may be seriously interfered with; the ranula filling the mouth, the goitre compressing the neck, and the polyp closing the womb.

In the second place, as the tumor progresses, it is apt, either by the continued pressure which it exerts upon the superimposed parts, or in consequence of the gradual decay of its own structure, to produce ulceration, followed by more or less discharge. This tendency, although most conspicuous in the heteroclite formations, is not peculiar to them, but is also witnessed in some of the benign growths, as the encysted and adipose. Large vessels are sometimes laid open during the progress of the disease, thereby inducing copious hemorrhage.

Tumors often occasion serious disease in the surrounding lymphatic ganglions. This is particularly true of malignant tumors, in

some of which it forms a very conspicuous and almost unmistakable feature. In cancer of the jaw the ganglions of the neck enlarge; of the breast, the ganglions of the axilla; and of the testicle, the ganglions of the groin; either by actual extension of the morbid action, or from sympathetic irritation.

Finally, an intimate *sympathy* exists between tumors and the constitution, operating at one time beneficially, at another, prejudicially. The progress of malignant growths is often stayed for months and years, simply by attention to the general health; on the other hand, it is frequently astonishingly hastened by disorder of the system, and, in fact, by whatever has a tendency to produce derangement of the secretions, especially those of the liver, uterus, and kidneys.

3dly. The *history* of the case often furnishes important points of comparison. Tumors occur at all periods of life, in both sexes, in all classes of society, and in all varieties of temperament. Certain forms of malignant disease, however, are most common at one period, and others at another. Thus, scirrhus is almost peculiar to elderly subjects, while encephaloid is most frequent between the ages of twenty and fifty. The scrofulous tumor is most common in childhood and adolescence. Benign growths of every description are often observed in early life, but the greatest number of cases occur in young adults.

Rapidity of growth and great bulk imply inordinate vascular activity, and lead to a suspicion of malignancy. There is no tumor that attains so great a bulk in so short a time as the encephaloid, and certainly none that is more surely fatal. Ovarian cysts of the non-malignant type, often acquire an astonishing development in a comparatively brief space. Sebaceous, polypous, osseous, and fatty tumors, on the contrary, usually grow slowly, and occasionally even enjoy a period of repose.

Constitutional involvement may be occasioned by sheer malignancy, or by the injurious effects exerted by the morbid growth upon important structures in its neighborhood. In general, rapidity of development, large size, and early formation of adhesions, along with enlargement of the lymphatic ganglions, and constitutional disorder, may be regarded as evidences of a malignant tendency.

Certain tumors have a tendency to return after extirpation; others, on the contrary, never relapse. All malignant growths, without exception, possess this repullulating tendency, and hence their removal is rarely followed by a permanent cure. Relapse, however, may also occur when the tumor is perfectly benign, but then it is generally dependent upon imperfect extirpation. Thus, an encysted tumor will almost be certain to recur if a portion of its sac be left behind.

It is seldom that a tumor disappears spontaneously; nevertheless, such an occurrence is possible, and there are several ways in which it may be effected, as by absorption, enucleation, ulceration, and gangrene. The former of these modes of cure is the most common; one of the best examples of it occurs in the scrofulous tumor, so frequently met with in the neck and about the angle of the jaw in strumous children, from exposure to cold and derangement of the digestive organs. The disease essentially consists in an inflammatory enlarge-

ment of one or more lymphatic ganglions, which, after having existed perhaps for years, finally goes away without any assignable cause, merely, to all appearance, in consequence of an improved state of the general health, and of a change in the nutrition of the part.

Sometimes a tumor becomes enucleated, and drops off, leaving perhaps merely its inclosing cyst. It is thus that the fibrous tumor of the uterus is occasionally detached; and the same thing may happen to an exostosis, particularly if it be large and situated upon the skull. In such cases the vascular connection between the morbid growth and the circumjacent structures is probably, as a preliminary step, in a great degree destroyed, so that the tumor, gradually dying and acting as a foreign body, is at length cast off by the living tissues.

A cure is occasionally effected by profuse suppuration, or, more correctly speaking, by suppuration and ulceration. The kind of tumor most easily influenced in this way is the scrofulous, which is either completely disintegrated and broken down, or it is dissected off, by ulcerative action, and is finally detached as an effete substance.

Lastly, gangrene seizing upon a tumor may so interfere with its circulation as effectually to destroy its vitality. Such an occurrence, although very rare, may take place in a malignant as well as in a benign growth. Some years ago, I attended an elderly lady on account of scirrhus of the mammary gland; after the disease had been going on for upwards of a year, the carcinomatous structures were suddenly attacked by gangrene, and in less than a week they dropped off in the form of a black slough, leaving in their stead a large excavated cavity.

SECT. II.—BENIGN TUMORS.

The benign or non-malignant tumors may be arranged under the following heads: 1. Hypertrophic; 2, vascular; 3, adipose; 4, horny; 5, fibrous; 6, cartilaginous; 7, osseous; 8, calcareous; 9, neuromatous; 10, cystic; 11, hydatic; 12, polypoid; and 13, myeloid. The latter, however, must, for the present, occupy an equivocal position in this arrangement. As for myself, I have very little doubt but that it will ultimately be found to be merely a variety of encephaloid.

1. HYPERTROPHIC TUMORS.

I employ the term "hypertrophic" to designate a class of tumors which are produced by the gradual enlargement of an organ, in consequence of an increase of its nutrition. A good type of this form of tumor occurs in the thyroid body, in what is generally known as goitre. This affection, which commonly begins very early in life, consists essentially in an abnormal development of the component elements of the gland, simply as the result of a preternatural supply of blood. What the immediate cause of this increased supply is does not admit of easy explanation. It is possible, although problematical, that it may originally depend upon inflammatory irritation; but, even if this be true, it can hardly be supposed that this action would con-

tinue through a series of twenty, thirty, and even fifty years, as we know it often does, from the steady and persistent increase of the morbid mass. Whatever, therefore, may set the process in motion must, after a time, cease to exert its influence, while the perverted movement, once begun, daily progresses, until the structures affected by it are incapable of further change. This idea derives additional support from the fact that goitre, after having attained a certain degree of development, often remains stationary for a long period, when, perhaps suddenly and without any obvious cause, it again commences to grow. If such a tumor be examined in its earlier stages, it will be found that, while the tissues are unnaturally red, firm, and distinct, and that, while the thyroid arteries which supply them with blood are unnaturally voluminous, there is no evidence whatever of plastic deposits justifying the belief that inflammation had any agency in the production of these changes. If, at a later period in the disease, we find various morbid products, such as the pathologist is accustomed to regard as the consequences of inflammation, it only shows that they are the result of secondary causes, developed during the progress of the hypertrophy, which is itself, no doubt, often a source of inflammation to the affected tissues.

Hypertrophy of the prostate gland, generally described as senile enlargement, is often produced in a similar way. The same cause usually presides over the development of those enormous growths of the mamma which are occasionally observed in young females, in which that organ has been known to acquire a bulk many times exceeding the natural one. Congenital enlargement of the tongue affords another well-marked example of the same mode of formation.

A chronically enlarged tonsil is another specimen of this form of tumor, only that the hypertrophy is usually attended with an inordinate amount of plastic deposit. The inflammation, however, after a time, frequently disappears; but not so the enlargement. On the contrary, when it has once been fairly established, it often steadily progresses until the gland has attained an enormous bulk, simply in consequence of the increased nutrition of its proper tissues, aided by occasional subsequent attacks of inflammation, to which the parts are always remarkably prone after having once been assailed by this disease.

The encysted tumor of the skin, the common sebaceous tumor of authors, is essentially a hypertrophic formation, awakened by obstruction of the outlet of a skin follicle, caused either by inflammation or by the impaction of sebaceous matter. The natural secretion being thus retained, presses upon the walls of the follicle in every direction, thus inviting a preternatural afflux of blood, probably attended, in the first instance, by interstitial deposits, but gradually subsiding as the cyst becomes tolerant of the presence of the altered and now foreign substance. That this is true does not admit of doubt, especially if we reflect upon the fact that this form of tumor often steadily increases for many years without any demonstrable evidence of inflammatory irritation.

To the same category as the above affections belong those chronic

lesions of the lymphatic ganglions in which there is not only more or less augmentation of their volume, but marked induration and alteration of their proper tissue. Sometimes a large tumor is formed in this way by a single gland, but, in general, such growths consist of an agglomeration of several bodies of this kind, united so as to form a bulky mass, of a nodulated character, and of extraordinary firmness.

If we adopt the term which I have here employed to designate these changes, we shall be able to dispense altogether with the word "sarcoma," introduced by Mr. Abernethy, and so constantly used since his time, in reference to certain alterations produced in our organs as a consequence either of simple supernutrition or inflammatory deposits, or both conjoined. Sarcoma literally signifies flesh, and is therefore wholly inapplicable, not only to this but also to every other form of morbid growth, which never has any resemblance, not even the faintest, to flesh. The sarcomatous testicle, for example, as it was formerly called, in conformity with the nomenclature of the English surgeon, is merely a chronic enlargement of that organ, the result of inflammatory deposits and supernutrition of its own structures.

The mammary gland not unfrequently enlarges in a similar manner, its substance being indurated and distinctly defined, but not so completely masked as to lose all trace of its primitive character. The organ is simply hypertrophied, and is therefore capable, under judicious management, of regaining its natural properties.

Much is to be expected from medical treatment in this class of tumors. The remedies upon which our chief reliance is to be placed are purgatives and sorbefacients, with strict attention to the diet. Occasionally, valuable aid is derived from topical bleeding, especially when there is decided evidence of overaction with tendency to plastic effusion from inflammatory accession. The bowels having been duly attended to, the best internal remedies are, in the more recent cases, the milder forms of mercury, and, in the more chronic, the different preparations of iodine, of which Lugol's solution and the iodide of potassium are entitled to preference. The object is to change capillary action and to promote absorption of redundant material, whether the product merely of simple or of perverted nutrition. The action of internal remedies is generally very much increased, under such circumstances, by local applications, employed so as not to irritate the skin and excite the secernents. They may consist of unguents, embrocations, or liniments, used several times in the twenty-four hours, their beneficial effects being aided by rest and other means calculated to favor restoration of structure and function. Blistering occasionally exerts a most powerful influence in affording relief. Cutting off the supply of blood to the part by tying the main artery leading to it has sometimes been successfully practised. Excision is performed only as a dernier resort; partial, as in the case of an enlarged tonsil, complete, as when the mammary gland or a lymphatic ganglion is involved.

2. VASCULAR TUMORS.

The vascular tumor essentially consists, as the name implies, of a network of small bloodvessels, connected together by areolar sub-

stance. It is generally met with as a congenital affection, its foundation being laid during fœtal life, and it is not uncommon for it to acquire a considerable bulk before birth. Most generally, however, it is quite diminutive when the child is born, and it often continues so until some time after, when, perhaps, all of a sudden, and without any assignable cause, it takes a new start, growing with remarkable rapidity. The ordinary sites of the vascular tumor are the head, face, and mucous membranes, especially that of the rectum, where it often presents itself in the form of what is called an internal pile. Their color ranges from a deep rose to scarlet or purple. They are of a soft, spongy consistence, and vary in size from that of a mustard seed to that of a fœtal head.

The vascular tumor exhibits considerable variety of structure; being sometimes essentially composed of veins, sometimes of arteries, and sometimes, again, of both arteries and veins together, so equally balanced, in number and caliber, as to render it difficult to determine which predominate. When the tumor is of an arterial character it generally pulsates synchronously with the left ventricle of the heart, and constitutes a real erectile growth, similar to that of the cavernous body of the penis. As these formations will claim special attention in the chapter on the diseases of the vascular system, no further notice of them will here be necessary.

3. FATTY TUMORS.

The fatty tumor is quite common. It may occur in any part of the body, with the exception, perhaps, of the palm of the hand, the sole of the foot, fingers, and toes. It is seen, however, more frequently about the back, shoulder, and neck, than in any other regions. The upper eyelid is also a common seat of it. Sometimes, but more rarely, it occurs in the orbit of the eye, in the walls of the abdomen, in the perineum, the labium, and underneath the tongue, and even in the substance of this organ. Large masses of this kind occasionally form in the internal cavities of the body, as in the omentum and mesentery, and around the kidneys.

The number of fatty tumors varies, in different cases, from one to several hundred. In general, they are solitary, or, at most, there are only two or three, occupying different regions of the body, or grouped more or less closely together. In a medical gentleman, aged thirty-eight, who attended my lectures some years ago, I counted upwards of two hundred, from the volume of a small pea up to that of a large marble. They all had a doughy, inelastic feel, and most of them were of a globular shape; a few were slightly flattened, or compressed. They were situated principally on the forearms, the inside of the thighs, the loins, abdomen, and pectoral muscles, the latter of which were literally covered with them. None existed on the head, neck, and upper part of the back. The general health was good, and the tumors had been first observed about sixteen years previously. During two severe attacks of acute disease, accompanied with great emaciation, many of them entirely disappeared. To satisfy myself of the true nature of

these tumors, I was permitted to remove one, about the size of a filbert, which proved to be composed entirely of fatty matter.

In their volume, these tumors vary from that of a small pea to that of an adult head. Sometimes, indeed, they are much larger, measuring many inches in diameter, and projecting a great distance beyond the surface. Professor Leidy presented to me, a short time since, a section of a fatty tumor which weighed upwards of seventy pounds; it had been developed in the abdomen of an elderly person, and contained large masses of bony matter. Dr. Bray, of Evansville, Indiana, some years ago, extirpated a fatty tumor which weighed nearly forty pounds. The patient made a good recovery.

In their shape, fatty tumors are generally somewhat globular, with a lobulated surface; but as they augment in volume they are liable to become elongated, and to assume a pyriform, gourd-like, or pediculated configuration. These changes, which are well represented in the annexed cut (fig. 25), no doubt depend upon their weight, by which they are gradually dragged out of their original shape, as well as position. For the same reason they sometimes shift their seat, descending from the point where they originally appeared to one below it, perhaps several inches distant. Thus, a fatty tumor developed in the groin, has been known, in time, to pass down between the scrotum and the thigh. This migratory tendency, which is interesting as a matter of diagnosis, is most common in those parts of the body which are abundantly supplied with loose cellular substance, and in those cases in which the tumor has a large bulk and a pediculated attachment.

Fig. 25.



Fatty tumor.

Fatty tumors are always invested with a capsule, by which they are connected with the surrounding structures, and through which they obtain their vessels, nerves, and absorbents. This covering is not a new formation, produced by inflammatory action, but is the result simply of a condensation of the circumjacent cellular substance; hence it varies very much in its appearance in different cases and in different circumstances. In the early stage of the affection, and especially when the tumor is diminutive, it is, in general, very thin, soft, elastic, and transparent; but in cases of long standing and large size, it is always more or less dense, firm, resisting, and of a fibro-cellular, or distinctly

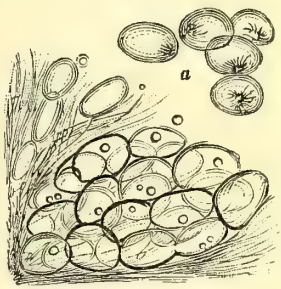
fibrous texture. Its thickness ranges between a mere film and a layer of a line or more in depth. External pressure, especially if long continued, and the pressure also of one part of the tumor upon another part, no doubt exert an important influence upon the anatomical character of this investiture, serving to adapt it to the varying circumstances of the shape and bulk of the morbid growth. The adhesion of the capsule to the skin is sometimes remarkably close, requiring great care in separating it.

Attached to the inner surface of this covering are numerous processes, which dip into the interior of the morbid growth, separating it into lobes, lobules, and granules, until the component tissues are resolved into their ultimate elements. These processes are usually very delicate; but occasionally, as when there is a hypertrophous condition of the fibro-cellular substance, they are quite dense and tough, forming distinct bands, of a whitish or grayish color, between the different structures.

Fatty tumors do not receive much blood, at least not as a general rule; hence they seldom bleed much when they are extirpated. It is only when they are of large size, or when they grow very rapidly, that they are likely to be very vascular. The capsule and its processes serve to conduct the vessels into the interior of the tumor, and to direct, as it were, the distribution of their branches and ramifications. As the morbid mass is always free from pain, and is tolerant of the rudest manipulation, it may be concluded that it receives very few nerves. Its absorbent vessels are also few in number. It may, furthermore, be inferred that, inasmuch as the general health is usually unimpaired throughout the whole progress of the affection, however long it may continue, it does not possess any important sympathetic relations with the general economy.

The minute structure of this form of tumor is well displayed in the annexed sketch (fig. 26). It is made up of cells, exactly similar to those of natural fat, interspersed through areolar tissue, as seen in the larger drawing; the small figure *a* represents isolated cells, showing the crystalline nucleus of margaric acid. Various other substances, of an adventitious character, generally present themselves upon the field of the microscope, in the form of molecules, granules, and globules, especially in old fatty growths. It is upon these accidental occurrences that some pathologists have attempted to found certain subdivisions of the fatty tumor, which, while they are of doubtful histological propriety, are altogether destitute of practical value.

Fig. 26.



Minute structure of a fatty tumor.

Fatty growths are most common in the subcutaneous cellular tissue, but they are not confined to this substance; for in many cases they send prolongations around the muscles, tendons, fasciæ, vessels, and other structures. Thus a fatty tumor of the neck has been known to

extend deeply between the trachea and œsophagus, or to dip in between the carotid artery and jugular vein, or to pass down behind the sternum and clavicle into the chest. A fatty growth of the wall of the abdomen sometimes extends into the cavity of that name; and, on the other hand, such a tumor occasionally begins in the subperitoneal cellular tissue, and ultimately descends through the inguinal canal, or some abnormal outlet, down into the scrotum, thus simulating hernia of the groin. It must be obvious that all such arrangements, which, however, are fortunately rare, must greatly embarrass both our diagnosis and our attempts to remove the morbid mass.

Fatty tumors are soft, doughy, and semi-elastic; properties which, in general, enable the surgeon readily to distinguish them from other morbid growths. Their boundaries are usually well defined, especially when they are superficial or pediculated. Sometimes, however, they are insensibly lost in the surrounding parts, being spread out beneath the skin, and sending processes among the muscles, or their fasciculi. In many cases they have an irregular, lobulated surface; while in other cases, and perhaps in the majority, they are perfectly smooth and uniform. There is no enlargement of the subcutaneous veins, no disease of the skin, no pain, and no tenderness on pressure. The progress of the tumor is, in fact, quite indolent; the only inconvenience which the patient experiences being caused by its weight and bulk. The general health is usually perfect. These circumstances, with a careful consideration of the history of each case, will commonly serve to distinguish fatty tumors from other morbid growths, whether benign or malignant in their character.

Fatty tumors are liable to inflammation, suppuration, ulceration, and gangrene. These events, however, are very infrequent, and are usually induced by mechanical pressure, by caustic applications, and by inefficient nourishment, in consequence of a loss of their vascular and nervous supply from the pendulous or overgrown character of the morbid mass. In a tumor of this kind, about the volume of an orange, which I removed many years ago from the top of the left shoulder of a girl of eighteen, the ulcer had a remarkably foul, unhealthy aspect, with thin, everted edges; the pain was at times quite severe, and the discharge was of a sanious nature, intermixed with globules of fat. Various attempts had been made, but without success, to heal it up, and no cause could be assigned for its formation. The general health had been a good deal impaired, and for some time past there had been irregularity of the menstrual function. The ulcer was included in the incisions, and a speedy recovery was the result.

When the fatty tumor becomes inflamed, it may suppurate, the pus occurring either as an infiltration or as a distinct abscess. Occasionally it serves as a nidus for the deposit of osseous matter, as in the case already referred to.

Again, such tumors now and then undergo a sort of fibrous or cartilaginous degeneration, not uniformly, but at certain points of their extent. Nodules, varying in size from a hazel-nut to a pullet's egg, may thus be formed, having a firm, characteristic consistence, more or less movable, and contrasting singularly with the other structures.

Finally, they occasionally contain cysts filled with various kinds of substances, as oily, serous, or gelatinous. The walls of the cysts may be very thin and transparent, or thick, opaque, and perhaps even partially calcified.

It is not easy to determine how fatty tumors are developed. The difficulty which surrounds the subject is not cleared up by assuming that they are merely hypertrophies of the natural adipose tissue. This is doubtless the fact; but we cannot explain why such an occurrence should take place at one point rather than at another, or why, indeed, it should happen at all. The exciting cause of the morbid growth has sometimes been traced to external injury, as a blow, contusion, or steady mechanical compression; but in the generality of cases no reason whatever can be assigned for its production.

Both sexes are liable to this formation, but whether in an equal degree or not, is not ascertained. It is most common in young adults and middle-aged persons.

The medical treatment of this class of morbid growths is most unsatisfactory; for there is no remedy of which we have any knowledge that is capable of arresting its progress, or causing its removal. If the reverse is occasionally the case, it serves only as an exception to the rule, and nothing else. The instance of Mr. Brodie, in which he succeeded in removing a large mass of fat from a man's chin and neck, by the free and persistent use of the solution of potassa, may be regarded as a remarkable example of unexpected success. He commenced with half a drachm of the fluid three times a day, and gradually increased the dose to a drachm. At the end of a month there was a sensible diminution in the volume of the tumor, which steadily continued as long as the medicine was persevered in. Some time afterwards Mr. Brodie substituted the tincture of iodine, which had just then come into use, but the tumor again increased. Finding this to be the case, the alkali was resumed and continued, off and on, until the tumor was almost entirely dispersed. Altogether, the man took an enormous quantity of the medicine. I am not aware that the same happy effects have been realized from this remedy by other practitioners.

All local applications are equally unavailing. This is true alike of steady and systematic compression, of mercurial and other inunctions, and of frictions with stimulating liniments and embrocations. The absorbent vessels in these tumors are few and feeble, and this is probably the reason why all remedies of this description are so utterly valueless as curative agents.

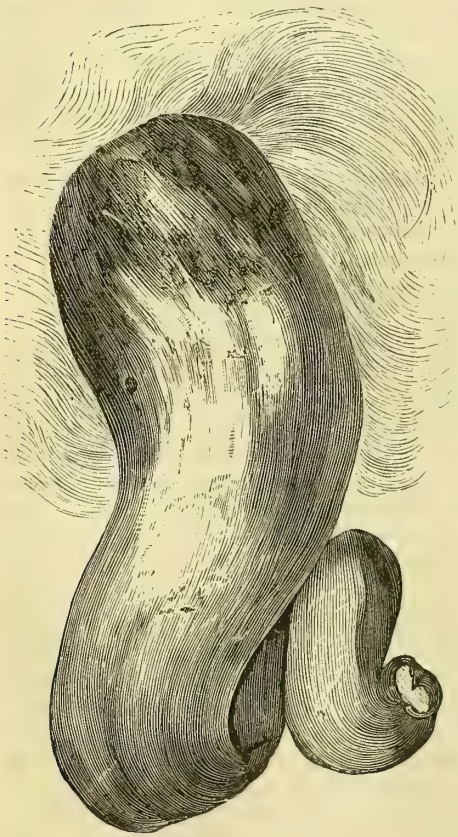
The manner of excising such tumors is generally sufficiently simple. Any diseased skin that may exist should be removed along with the morbid mass, which should be enucleated by a rapid dissection, care being taken that not a particle of the deposit is left behind; otherwise reproduction may take place. When the tumor is superficial the operation is easily performed and soon over; but when it is deep-seated, or when it sends processes among the surrounding structures, it may be one of great difficulty and perplexity, requiring the most consummate skill for its successful execution, and the most thorough knowledge of the anatomy of the parts. For the reasons already men-

tioned, the operation is sometimes nearly bloodless. I have, indeed, seldom found it necessary to apply more than two or three ligatures, whatever may have been the volume of the tumor.

4. HORNY TUMORS.

The skin is occasionally the seat of a very curious growth, known as the horn-like excrescence, from its resemblance to the horn of the sheep and goat. A more appropriate name would be the horny tumor. It is met with principally in those parts of the body which abound in sebaceous follicles, as the face and forehead. In seventy-one cases collected by Villeneuve, the tumor in twenty-six was seated on the scalp, in five on the nose, in two on the cheek, in one on the lower jaw, in four on the chest, in four on the back, in three on the anus and penis, in four on the buttocks, in twelve on the thigh, in two on the knee, in two on the ham, in one on the leg, and in three on the foot. In the cases that have come under my own observation it was seated on the lower lip, the ear, and the chin; others have met with it on the scrotum and hand. It appears to occur with nearly equal frequency in both sexes, and it occasionally begins at a very early period of life, although in the great majority of instances it does not come on until after the age of forty. In two cases I have seen small but well-marked growths of this kind in children under ten years of age. Several such excrescences are sometimes observed in the same person.

Fig. 27.



Horny excrescence growing from the scalp.

The size, shape, color, and consistence of the horny tumor are subject to much diversity, depending upon its age, and other circumstances. A length of from three to six inches by half an inch to an inch in diameter (fig. 27), is by no means uncommon. In the British Museum there is said to be a growth of this description, eleven inches in length by two

and a half in circumference; and examples of a still more remarkable nature have been reported by authors. In that curious book, An Essay for the Recording of Illustrious Providences, by Increase Mather, are briefly mentioned the particulars of the case of a "man that has an horn growing out of one corner of his mouth, just like that of a sheep; from which he has cut seventeen inches, and is forced to keep it tyed by a string to his ear, to prevent its growing up to his eye."

The shape of these excrescences is usually conical, being larger at their adherent than at their free extremity, which is always somewhat tapering, and their direction is either spiral, twisted, or bent, so as, in the main, to bear a striking resemblance to that of the horn of a sheep. In a case recorded in the New York Medical Repository for 1820, an enormous growth of this kind, measuring fourteen inches in circumference at its shaft, is stated to have consisted of three branches. The surface is generally marked by rough circular rings, indicative of the successive steps of their development. Now and then it is imbricated, knobbed, or covered with small pearl-colored scales. In color they vary from a dingy yellow to a dark grayish, brown, or black, according to their age, and the amount of their exposure. They are more or less flexible, and of a firm, fibro cartilaginous consistence. Their internal arrangement, as seen on a section, is longitudinally lamellated, as in figure 28.

Fig. 28.



A section of a horn, showing its lamellated structure.

When burned, these excrescences exhale a characteristic animal odor. Chemical analysis shows that they are chiefly composed of albumen, in union with a small quantity of mucus, phosphate of lime, and chloride of sodium, with a trace of lactate of soda. On the addition of acetic acid, numerous epidermic scales become apparent, possessing all the characteristic properties of such structures. Under the microscope, the minute structure of these morbid growths exhibits epithelial cells, which, according to Erasmus Wilson, are of a flattened shape, closely condensed, and, here and there, of a fibrous arrangement. They are somewhat larger than those of the epidermis, and possess nuclei, for the most part of an oval shape, their long diameter measuring $\frac{1}{2500}$, the short $\frac{1}{3300}$ of an inch. The average size of the flattened cells is about five times greater than that of the nuclei.

Human horns are generally, if not invariably, connected with the sebaceous follicles, in which they probably take their rise. Their development is frequently directly traceable to the effects of chronic inflammation, such, for example, as is produced by a burn, wound, or contusion. When first observed, they are quite soft, semi-transparent, and invested by a distinct cyst, which, extending over their base, is gradually and insensibly lost upon their trunk. Very soon, however, they become hard, and, assuming a darker hue, thus acquire the real properties of the horny tissue as it exists in the inferior animals. Their growth is always very slow, from three to five years elapsing before they attain any considerable bulk.

Although these excrescences sometimes drop off spontaneously, yet a cure rarely, if ever, follows such an event; for as the matrix remains, it soon becomes the starting-point of a new growth, which, pursuing, the same course as its predecessor, may, in time, acquire a similar, or even a greater, bulk. The proper remedy is extirpation, performed in such a manner as to include the whole of the epigenic cyst in two elliptical incisions, the edges of which are afterwards carefully approximated by suture and adhesive strips. It has been suggested that we might get rid of these bodies by softening and dissolving them with alkalies and water-dressings; and then, after they have dropped off, to prevent their reproduction by touching the matral cyst freely and repeatedly with nitrate of silver, with a view of preventing the tendency to abnormal cell-formation. Such a procedure, however, besides being tedious, must be very uncertain, and is, I imagine, altogether more disfiguring in the end than excision.

5. FIBROUS TUMORS.

The fibrous tumor owes its name to the peculiarity of its structure, which strongly resembles the fibrous tissue in the normal state. One of the best specimens of this variety of morbid growth is to be found in the uterus of elderly females, where it sometimes attains a weight and magnitude equal to those of the body of the patient. It also occurs in the cellular tissue, both subcutaneous and intermuscular, in the testicle, the ovary, and other parts of the body. My cabinet contains a large fibrous tumor, weighing nearly five pounds, which I removed from the interior of the scrotum of a young man of twenty-five, but which had no connection whatever with the testicle. A remarkable fibrous tumor is sometimes seen growing pendulously from the lobe of the ear. Keloid formations of the skin obviously belong to the present class of morbid products, although they usually contain an inordinate quantity of plastic material. Fibrous growths occasionally occur in the interior of the joints, especially the elbow and knee, in the latter of which they sometimes attain the volume of a pullet's egg. The dura mater, periosteum, and fibrous envelopes of the muscles are all liable to their formation, although the occurrence is unusual. Finally, fibrous tumors are often met with in the neck, either just beneath the skin or deep among the muscles and lymphatic ganglions.

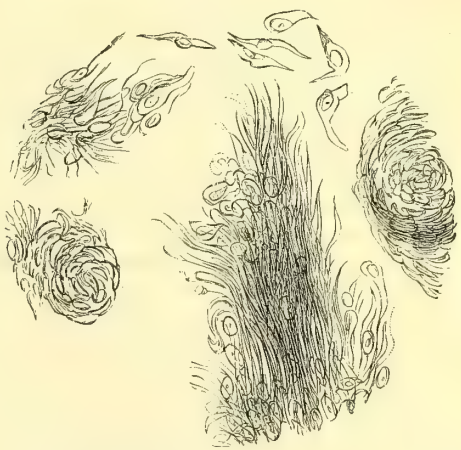
The fibrous tumor, although of slow growth, may, in time, acquire an enormous bulk, as is exemplified in the immense masses which we occasionally find in the neck, the uterus, and some other parts of the body. It feels heavy and incompressible, is globular, ovoidal, or pyriform in shape, and has generally a smooth, even surface, although cases not unfrequently occur where it is remarkably lobulated, or marked by numerous elevations and depressions. In the uterus and the joints it is often attached by a narrow neck, but almost everywhere else it is in immediate contact, on all sides, with the structures in which it is developed, its adhesions being effected solely by cellular tissue. Generally solitary, it occasionally occurs in considerable numbers, more

particularly in the uterus, where there are sometimes from six to a dozen in the same specimen.

The structure of the fibrous tumor is characteristic. As its name indicates, it is composed of fibrous matter, the filaments of which cross each other in every conceivable manner, forming thus an intricate network, which the most careful dissection fails to unravel. These filaments are of variable size and shape, and are so intimately compacted together as to constitute a dense, firm, inelastic substance, so characteristic of this kind of product. It is only in rare cases that their passage across each other leaves any interspaces for the lodgement of fluid or solid matter. They are of a grayish or pale drab color after maceration, but in their natural state they are rosaceous, reddish, or even purple, their complexion depending upon the amount of blood they contain. Occasionally they have a silvery, glistening appearance.

The fibrous tumor has seldom any distinct capsule; the tissues around it are, it is true, usually a good deal condensed and thickened, but the covering thus derived is altogether adventitious and secondary, forming none of the essential elements of its growth. Few vessels can be traced into its substance, and these are rarely of any considerable size; a circumstance the more surprising when it is recollected what immense bulk it sometimes acquires. No reliable chemical examination has yet been made of this variety of tumor, but it is probable that it consists essentially of gelatine, as this substance is largely furnished by protracted boiling. Under the microscope it exhibits nucleated cells, sometimes in great numbers, of an oval, rounded, or elongated form, which are always rendered very conspicuous if the part be previously treated with acetic acid, as in fig. 29.

Fig. 29.



Microscopical characters of a fibrous tumor from the submaxillary region, from a drawing by Dr. Packard.—472 diameters.

Growths of this kind sometimes contain colloid matter, lodged in distinct cells in their interior; it possesses the ordinary physical and microscopical characters, and probably serves to give additional impulse to the development of the tumor, which often increases with great rapidity, and thus soon acquires a large bulk.

The fibrous tumor seldom takes on malignant action, although it is not incapable of it. Its general tendency is gradually to increase, to impair function, and ultimately to wear out life by its secondary effects. The older formations of this kind nearly always contain adventitious

deposits, especially the calcareous, which often exists in considerable quantity. The cartilaginous is also not uncommon. Sometimes large cavities, containing serosity, pus, and other substances, are found in them. Their progress is usually painless, except when they compress important parts, the inconvenience which they occasion being dependent mainly upon their weight and bulk.

There is a form of fibrous tumor to which the term *fibro plastic* has recently been applied, as denotive of its peculiar composition. It is, in fact, merely a modification of the one just described, with a predominance of the plastic element, or, at all events, a very conspicuous exhibition of it. It is met with chiefly in certain pendulous growths of the ear, in elephantiasis, and in certain formations of the skin, especially in keloid. It is also found in the subcutaneous and intermuscular cellular tissue of the neck, trunk, and extremities. When cut, it grates under the knife, the surface exhibiting a pale yellowish, greenish, or bluish glistening basis-substance, intersected by whitish, opaque filaments. These filaments, which, by their interlacements, form the stroma of this variety of tumor, are generally disposed in wave-like lines, but in many specimens they are very irregular, and seem to observe no definite arrangement. The matter which occupies the cells of the stroma is very succulent, being pervaded by a peculiar fluid, of a yellowish, oily appearance, which gives the mass an infiltrated, anasarcous condition.

The fibro-plastic tumor essentially consists of plastic matter, its development being effected from nucleated blastema, in the same manner as in ordinary lymph-growth. It occurs principally in young and middle aged subjects, and is usually more rapid in its march than the purely fibrous formation, into which it sometimes partially degenerates, its plastic material being supplanted by the fibrous.

The fibrous tumor, as already stated, sometimes takes on malignant action, its tissues serving as a nidus for the deposition of carcinomatous matter. It is impossible to determine what are the circumstances which predispose to, or influence, such an occurrence; but there can be no doubt that it is governed by the same laws as those which preside over the development of cancer in the primitive structures generally, and that the change does not consist merely in a degeneration, properly so termed, of the fibrous substance, but of an entirely new formation. What has recently been described as the *recurring fibroid tumor* is probably originally of a malignant nature, but does not show its real character until it is called into play by some disturbing agency, either local or constitutional, or, perhaps, both. At all events, this morbid growth often remains for a long time in a state of latency, when, it may be all of a sudden, it assumes an extraordinary degree of activity, and soon exhibits the worst malignant tendencies. Casual inspection of the fibroid tumor might lead to the supposition that it was of a fatty substance, so closely do its external properties resemble those of the adipose tissue; but a careful examination with the microscope soon dispels this illusion, and clearly proves that it is essentially composed of the fibrous element, with, now and then, a small quantity of oily or fatty ingredients. Its texture is sometimes remarkably lobulated,

soft, and even brittle, the slightest traction separating it into numerous fragments; it often sends out small processes, which, extending far among the surrounding structures, are apt to be left behind during extirpation, unless great care is used in tracing them out. In its color it varies from drab or grayish to white or pale yellowish. A very common site of this tumor is the superior maxillary sinus; it is also not unfrequently seen upon the face, especially at the side of the nose, taking its rise, apparently, in the periosteum of the upper jaw.

The diagnosis of the fibrous tumor must mainly be deduced from its history, and its consistence. Its development, as a general rule, is tardy, there being a marked difference, in this respect, between it and the carcinomatous formations, even between it and scirrhus. Usually beginning in a little hard nodule, or lump, several years commonly elapse before it attains any considerable bulk, especially when it is developed among the external tissues; its progress is comparatively painless, the chief inconvenience occasioned by it being of a mechanical nature. The tumor feels hard, firm, and inelastic; it is more dense than encephaloid, but not as solid and dense as scirrhus. Its consistence is usually uniform; not hard at one point, and soft at another, but of the same character throughout. Its surface, too, is commonly smooth; and there is nearly always, unless the growth is very large, an absence of enlargement of the subcutaneous veins. In its earlier stages it is somewhat movable, except when it springs from the periosteum; but by degrees it contracts adhesions, and becomes firmly fixed in its position.

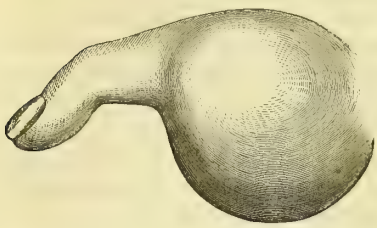
The fibrous tumor is rarely amenable to local or constitutional means. When it is favorably situated, pressure, steadily and systematically pursued, may sometimes be serviceable; but it is so seldom that this is the case that hardly any calculations of a curative character are to be based upon it. In the early stage of the development, before any great firmness and density of structure have been attained, a mild course of mercury may be tried, its constitutional impression being persistently yet most gently maintained for several successive months, or alternated with that of iodide of potassium, also an agent of some consequence in the softer forms of fibrous growths, although rarely of any benefit in those of maturer development. But the surest remedy, when the tumor is accessible, is excision, performed early and efficiently, by dissection and enucleation. Hemorrhage is usually slight, and recurrence impossible, unless, as sometimes happens, the morbid mass has become the nidus of carcinomatous deposit. As this cannot always be certainly predicted beforehand, the prognosis should not be too sanguine.

6. CARTILAGINOUS TUMORS.

The cartilaginous tumor, to which Müller has applied the term enchondroma, holds, histologically speaking, a position intermediate between the fibrous and osseous, being harder than the former and softer than the latter. Occurring in various parts of the body, as the ovary, testicle, mamma, and parotid gland, as well as in the inter-

muscular cellular substance, it is most frequently found in connection with the skeleton, its most common sites being the metacarpal bones and the phalanges of the fingers. I have seen large and numerous growths of this kind form simultaneously upon both hands and both feet, causing hideous deformity and almost complete loss of function of the affected parts. Although it occasionally takes place in elderly subjects, yet it is by far most frequent in young persons, especially such as are of a weak, rickety constitution; and is often associated with a remarkably stunted state of the body. The annexed sketch (fig. 30) conveys a good idea of the external characters of a cartilaginous tumor as it occurs upon one of the fingers.

Fig. 30.

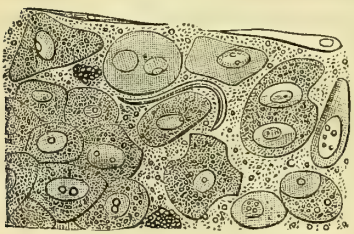


Enchondromatous tumor: external view.

The structure of this variety of tumor is subject to great diversity; hence it is rarely found to be of a uniformly cartilaginous character, but, in most cases, its substance is intermixed with fibrous and fibroplastic matter, if not also with more or less of osseous, or calcareous, especially when the growth is of long standing; not unfrequently it contains large cysts filled with various kinds of substances, either solid or fluid. To the hand it generally imparts the sensation of unusual firmness and solidity; it is destitute of elasticity, is generally distinctly circumscribed, and is nearly always strongly adherent to the structures from which it springs. Its surface is sometimes smooth, but more commonly it is lobulated, or marked by irregular prominences and depressions. No pain usually exists, or, if suffering is present, it is owing rather to the pressure which the tumor exerts upon the neighboring parts than to any disorder of its own sensibility.

Ordinarily the consistence of this tumor ranges from that of the vitreous humor, or solid albumen, to that of cartilage, different sections of it often exhibiting, as just stated, different degrees of firmness. In general, the mass is easily cut with the knife, the instrument sometimes causing a creaking noise. It is of a whitish, grayish, or bluish aspect, and is characterized by a peculiar linear arrangement. Under the microscope it presents numerous cells (fig. 31) of an oval or rounded shape, from the $\frac{1}{700}$ to $\frac{1}{1500}$ of an inch in diameter, loosely embedded in an intercellular hyaline substance, and containing each one or more nuclei and nucleoli. In the older growths, some of the nuclei and nucleoli are shrivelled, others are filled with oil granules, while others, again, are marked by projections similar to those of cartilage in process of ossification.

Fig. 31.



Minute structure of enchondroma.

Chemistry has shown that this tumor is composed, in great measure, of chondrine, a peculiar form of gelatine, in union with phosphate of lime. The animal matter is readily extracted by boiling, and differs from ordinary gelatine chiefly in being precipitated by some of the salts of lead, alum, and iron.

The cartilaginous tumor is sometimes enveloped by a distinct cyst, composed of condensed cellular substance; at other times, it is entirely destitute of such a covering, especially when it originates in the interior of the organs. Its vascularity is often very great, a circumstance which readily explains the astonishing rapidity which occasionally marks its growth, cases having been observed in which, in the course of a few months, it attained the bulk of an adult's head, or even of the chest of the patient. Such an occurrence, however, is extremely uncommon; for, in general, the progress of the cartilaginous tumor is singularly tardy, although it may, in time, acquire an extraordinary volume.

The progress of the cartilaginous growth is variable; in general, it is painless and indolent, causing little or no inconvenience, save what results from its weight and mechanical pressure; sometimes, however, it inflames and ulcerates, and in this way a large cavity is occasionally formed, attended with copious discharge and excessive constitutional disturbance, rapidly followed by hectic fever. Portions of such tumors sometimes, as already stated, undergo various transformations, as the cystic, fatty, and calcareous. It is also probable that it may occasionally become the seat of carcinoma, resembling, in this respect, some of the other benign formations. The only remedy for this tumor is early and efficient extirpation. When it is closely connected with bone, amputation will generally be required.

7. OSSEOUS TUMORS.

Osseous tumors, usually known by the name of exostoses, are mostly found in connection with the skeleton, especially the skull and thigh-bone, presenting themselves in various forms and sizes, from that of a pea up to that of a fœtal head; hard and compact, like normal bone, which they closely resemble in structure and composition; slow and painless in their progress; never degenerating into malignant disease; unamenable to ordinary medication; and requiring removal only when they seriously interfere with the exercise of important functions. The exciting cause of this class of tumors is not well understood; occasionally their development may be traced directly to external injury, but in general no reason whatever can be assigned for it. Commencing usually upon the outer surface of the bone, beneath the periosteum, their foundation is sometimes laid in the periosteum itself, the connection with the primitive bone being, perhaps, originally of a cartilaginous character. The osseous tumor is most common in persons after the meridian of life, and occasionally occurs in large numbers, depending apparently upon the existence of a real exostotic diathesis.

8. CALCAREOUS TUMORS.

The calcareous tumor is very uncommon, and is generally the result of a degeneration of a lymphatic ganglion, nearly always one of the neck, in the vicinity of the lower jaw. The gland having perhaps been for a long time enlarged and indurated, usually from a deposit of tubercular matter, gradually diminishes in size, and is finally transformed into a hard, firm, substance, resembling baked earth. It has none of the properties of genuine bone, and consists almost entirely of carbonate and phosphate of lime, cemented together by a minute quantity of animal matter. It is usually of small size, of a spherical form, and surrounded by an imperfectly constructed capsule. As it is not amenable to absorption, the proper remedy is excision, performed whenever it is found that the little tumor is in the way of comfort, or good looks.

Calcareous deposits are sometimes found in other structures, as fibrous tumors of the uterus, the vaginal tunic of the testicle, the bronchial lymphatic glands, and the pulmonary tissues; but as they do not interest the surgeon they may well be passed over here.

9. NEUROMATOUS TUMORS.

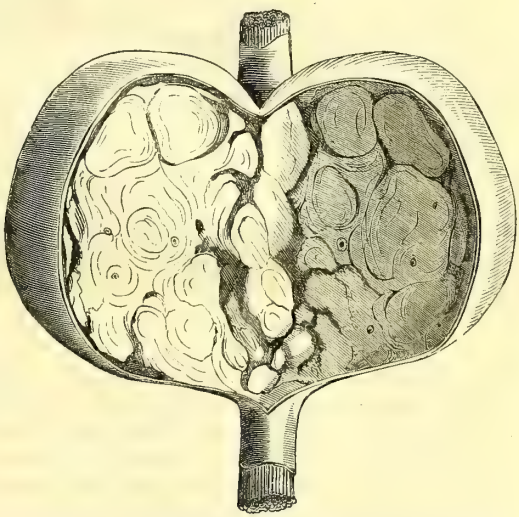
The nerves of animal life, especially the radial, ulnar, median, tibial, and peroneal, are subject to two forms of tumors, or morbid developments, known, respectively, as the neuromatous growth and the painful tubercle, although their structural differences are not always very well defined. The latter of these affections, incidentally noticed by Petit, Cheselden, and other observers, was first accurately described by Mr. William Wood, of England, in 1812. The neuromatous tumor, properly so denominated, has been particularly studied and delineated by Mr. Robert W. Smith, of Dublin, who published a splendid monograph on the subject in 1849.

The neuromatous tumor may be solitary, or there may be a considerable number, varying in size from that of a pea to that of an almond, an egg, or even an adult head. It is solid to the touch, firm, inelastic, and of an oblong, ovoidal, or irregularly compressed form. When small, it has generally a distinct cyst, of a cellulo-fibrous structure, filled with a transparent jelly-like substance, and developed within the neurilemma of the affected nerve, the filaments of which are separated from each other, and spread out over the surface of the tumor. In cases of long standing, or when the tumor has acquired an unusual bulk, the morbid mass is remarkably dense, white, or nearly so, homogeneous, and destitute of a cyst, properly so called.

The neuromatous tumor occurs in both sexes, and at various periods of life, though it is most common in males and in middle age. Its progress is usually slow, and it seldom attains any great volume. The exciting causes are generally very obscure, but in some cases it is plainly traceable to the effects of external injury, as a wound, blow, or bruise. Occasionally it follows upon amputation, the nerves of the stump becoming enlarged and bulbous. The pain which attends this

disease is very variable, both in degree and character. In most cases it is of a neuralgic nature, exceedingly severe, sharp, darting, pungent, or stinging, and liable to periodical exacerbations, dependent apparently upon atmospheric vicissitudes, and disorder of the digestive functions. The slightest pressure, friction, or manipulation causes an increase of suffering, which, under such circumstances, not unfrequently amounts to great agony. The parts beyond the tumor, especially those supplied by the affected nerve, are cold, numb, and almost powerless. The pain is sometimes seated in the neighborhood of the tumor rather than in the tumor itself; and occasionally, again, though this is rare, there is an entire absence of local distress. The general health may remain good, but in the great majority of instances it is more or less impaired; and the system, constantly tortured by the excessive suffering, is gradually reduced to the utmost prostration.

Fig. 32.

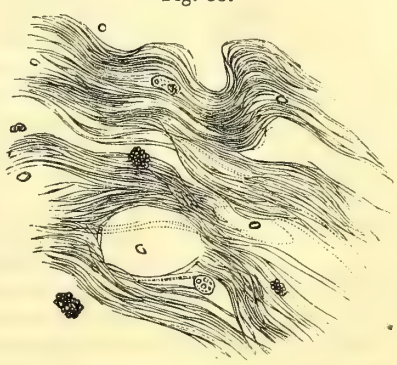


Section of a neuromatous tumor, with the nerve passing to and from it.

The accompanying sketch (fig. 32) affords an excellent illustration of the anatomical characters of a neuromatous tumor of the leg, situated along the course of the peroneal nerve. It had existed for nearly twenty years, during the last three of which it had been exquisitely tender and painful. The extirpation was effected by Dr. Dalton and Dr. Hoffman, of Ohio, who were kind enough to send me the specimen. The operation was followed by sloughing of the fourth and fifth toes.

A large quantity of fibrous matter enters into the composition of the neuromatous tumor, forming a stroma interspersed with granules and corpuscles, as seen in the annexed wood-cut (fig. 33).

Fig. 33.

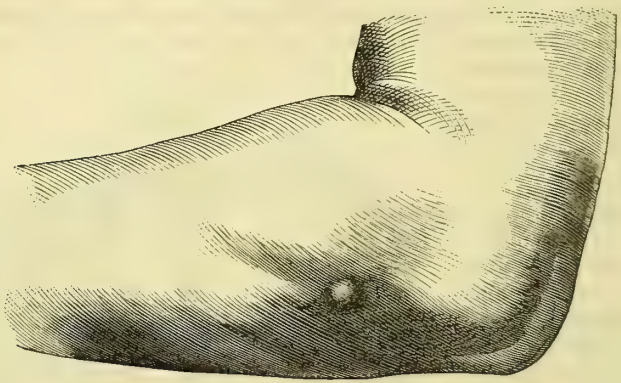


Microscopic structure of a neuromatous tumor.

The only effectual *treatment* is excision. As long, however, as the tumor is painless, or causes no inconvenience by its size or situation, the best plan is to let it alone. When the reverse is the case it is

our duty to extirpate it. The operation is usually quite simple, and devoid of danger. In general, an attempt should be made to enucleate the tumor, by pushing aside the nervous filaments which are spread out over its surface, and which may thus occasionally be preserved from harm. When this is impracticable, from the manner in which the parts are fused together, the morbid mass should be exposed by a free incision, and lifted out of its bed by dividing the affected nerve immediately above and below, over a grooved director. The loss of motion, occasioned by this proceeding, even when it involves a com-

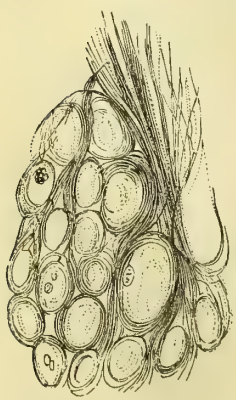
Fig. 34.



Painful subcutaneous tubercle.

paratively large nerve, is usually restored in a very short time. Indeed, the chief inconvenience to which it gives rise is a sensation of coldness in the distal part of the limb, which may, however, remain for years. Amputation has been resorted to for the cure of this complaint; but it is difficult to conceive of a case where it would really be necessary.

Fig. 35.



Microscopic structure of the subcutaneous tubercle.

The painful subcutaneous *tubercle* (fig. 34) is generally situated, as the name implies, just beneath the skin, in the areolar tissue, where it is usually connected with one or more very delicate nervous filaments, slightly enlarged, and surrounded by cellulo-fibrous, fibrous, or fibro-cartilaginous matter, freely interspersed with corpuscles, as seen in the adjoining sketch (fig. 35). On being cut out, it looks very much like a small mass of adipose substance. Few vessels can be discerned in it. It is always remarkably small, seldom exceeding the volume of a pea; very movable; exquisitely tender to the touch; and the seat of frequent pain, often of a neuralgic character, and subject to constant exacerbations from the most trifling causes. It is said to be most common in the lower extremities, but

this does not accord with my experience, most of the cases that have come under my observation having occurred in the arm, forearm, and shoulder.

The painful tubercle is generally single, or, if multiple, it is seldom that we see more than two or three in the same person. It occurs in both sexes, but much more frequently in women than in men, the reverse being the case in regard to the neuromatous tumor. Its development is usually tardy, and several years often elapse before it becomes very tender and painful. Women of a nervous, hysterical temperament appear to be most prone to its occurrence. During its development it always involves the skin.

The situation of this tumor just beneath the skin, or in the skin and areolar tissue, the absence of discoloration of the surface, the peculiar character of the pain, the intolerance of manipulation, and the history of the case, will generally suffice to determine the diagnosis.

The only remedy for this affection is free excision, including a small portion of the surrounding healthy integument. The disease never returns at the cicatrice, although it may occur afterwards in other parts of the body.

10. ENCYSTED TUMORS.

The class of encysted tumors is a large and important one; for it comprises quite a number of morbid products, which, whether they be viewed with reference to the frequency of their occurrence, or the extraordinary bulk they are capable of attaining, deserve more than ordinary attention. Their contents, which are of a singularly diversified character, may be either solid, semi-solid, or liquid. Their structure is sometimes very simple; at other times extremely complex. Hence, the division of encysted tumors into simple and compound. In regard to their origin, some are of new formation, but many, if not most, are merely so many alterations effected in the primitive structures; in fact, merely so many hypertrophies. Occurring in nearly every organ and tissue of the body, they are particularly liable to show themselves in the skin and mucous membranes, the glandular organs, as the breast, testicle, liver, and thyroid body, in the ovaries, and in the subcutaneous cellular substance. While no period of life is exempt from them, they are most common between the ages of twenty and forty-five, especially in females, who are also more subject to them than males, and in whom they occasionally attain an enormous volume.

In respect to their structure, some of these tumors are of the most simple character possible, consisting merely of a thin cyst, sac, or capsule, occupied by the natural secretion of the part, more or less altered by its protracted retention. An excellent type of this variety of morbid product is afforded by the sebaceous tumor, which is, in reality, nothing more than a sebaceous follicle of the skin, in a state of hypertrophy from the occlusion of its orifice, and the consequent retention of the sebaceous matter. The immediate cause of the obstruction is inflammation, producing adhesion of the opposite edges of the outlet of

the follicle, and thus constituting the first link in the chain of morbid action. The second is the retention of the normal secretion of the follicle, which, being tightly pent up, undergoes important changes, both in its physical and chemical properties, leading to irritation, and sometimes even to inflammation of the sac, which, gradually enlarging before the accumulating and burdensome mass, at length forms a tumor perhaps as large as a medium-sized orange. The little encysted tumor which we sometimes find upon the lower lip and upon the vulva arises in a similar manner. The probability is that ranula owes its origin to a similar circumstance. Certain encysted tumors beneath the skin, containing serum, blood, or solid matter, are produced by the occlusion of one of the cells of the cellular tissue, the walls of the affected cavity forming a characteristic cyst. Obstruction of a lactiferous duct has been known to produce the encysted milk tumor of the breast. In all these instances, as well as in many others that might be adduced, we perceive that the mode of formation is extremely simple, obstruction of the natural outlet of the part, and the retention of its proper secretion being the exciting cause of the disease.

Sometimes the cysts which form the distinguishing feature of this variety of morbid product are an entirely new growth, and then it is not always easy to explain their origin. The cysts which are found in cystic sarcoma of the testicle have been supposed to owe their development to obstruction of the seminiferous tubes, but I question whether such a mode of explanation is at all tenable. In the few cases in which I have had an opportunity of examining these tumors, I have been led to conclude that their origin was altogether foreign to the canalicular structure of the organ. It is certain that hundreds, and sometimes thousands, of cysts are formed in the testicle long after its seminal tubes are apparently completely annihilated, as is proved by the large size which such tumors often attain, and by the total absence of the primitive structures. The more plausible conjecture is that the development is effected in the plastic matter which accompanies the morbid action, in the same manner that cells are formed in the original tissues. The cysts found in osteo-sarcomatous formations of the lower jaw have probably a similar origin.

The contents of this form of encysted tumor must necessarily vary, as may be gathered from what precedes, according to the structure and functions of the affected part. Thus, in the mamma the tumor contains milk, in ranula saliva, and in a sebaceous formation sebaceous matter; altered, in every instance, in its physical and chemical properties, by the action of the inclosing cyst. The cyst itself is always solitary, and generally composed of a single layer, its external surface, which is rough and flocculent, being adherent more or less firmly to the surrounding tissues, while the internal one is usually smooth, shining, or glossy, without septa, and in immediate but loose contact with the proper contents of the tumor. It is usually of a cellulo-firous structure, and varies in thickness from the merest film up to that of a stratum several lines in depth. In cases of long standing we find it occasionally partially converted into a substance resembling fibro-cartilage, cartilage, bone, or earthy matter.

A cyst is said to be *multilocular*, or compound, when it consists of a number of compartments, cells, or cavities, or, to use a familiar expression, rooms, or chambers. This arrangement is brought about by the existence of membranous processes, which are attached to the inner surface of the parent cyst, from which they branch out so as to intersect each other in different directions. It might be very easily imitated by sewing pieces of linen across a common bag, separating the main cavity into a number of small ones. The chambers sometimes communicate with each other; at other times they are perfectly closed at every point. What is very remarkable about them, is that they frequently contain different kinds of products; one, perhaps, a serous fluid, another a jelly-like substance, another blood, and, finally, a fourth, perhaps, a solid material. In general, the older the cyst is the more likely will it be to contain some outré substance. The walls of these sacs are generally very thick, and of a dense fibrous structure, with a tendency to the fibro-cartilaginous degeneration. The septa, or internal partitions, are of a similar character. Numerous vessels occur in them, thus enabling us to explain the rapid growth and large bulk which these tumors occasionally attain.

The most common situation of this tumor is the ovary; it is also found in the mammary gland, the thyroid body, the testicle, and the cellular tissue. It is of irregular shape, and often grows with great rapidity.

Encysted tumors are seldom benefited by constitutional medication; indeed, apparently never, except in so far as it may have a tendency to improve the general health, and thus retard their development. Their contents do not seem to be amenable to the action of the absorbents. When situated superficially and of small size, they are sometimes benefited, though seldom cured, by compression, aided by sorbefacient applications, particularly the dilute tincture of iodine. A more certain plan is to break the cysts or incise them subcutaneously, so that, their contents having escaped into the surrounding cellular substance, their walls may collapse, and ultimately unite by adhesive inflammation. When the tumor, however, is deep-seated, sometimes iodine injections may be advantageously employed, the operation being performed in the same manner as in hydrocele of the vaginal tunic of the testicle. A seton, too, is an eligible procedure. When the cysts are large or numerous, and, above all, when the primitive textures are, in great measure, if not entirely, annihilated, the only course likely to succeed is excision of the entire mass, care being taken not to leave the slightest remnant, otherwise reproduction will be certain to occur. Too much stress cannot be laid upon this injunction. For want of this precaution, I have known a patient obliged to submit to not less than three distinct operations for the cure of a tumor originally not larger than a pigeon's egg, and which ought to have been effectually removed at one sitting. A secreting surface, hardly the size of a pin's head, is large enough to re-awaken disease. The removal may sometimes be effected by enucleation; at other times, and more generally, a minute dissection is necessary. The proceeding need not be at all bloody, unless the tumor is seated

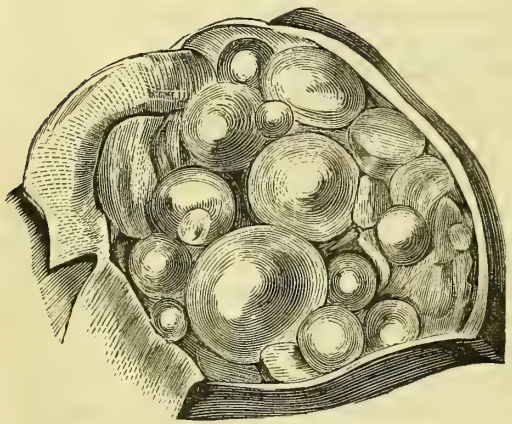
among very vascular parts, or the knife is carried too far away from the encysted mass.

11. HYDATIC TUMORS.

Under this head I propose to describe a form of morbid growth, essentially dependent upon the development of a cyst, inclosing an entozoon, vesicular worm, or parasite, denominated a hydatid. It is, as will be perceived, altogether different from the other varieties of cystic tumors, and therefore requires separate consideration. The term hydatid is a generic one, including several species of vesicular worms, of which the most important, surgically considered, is the acephalocyst.

This hydatid most commonly infests the liver, ovary, and uterus, but is also met with, although very rarely, in the mamma, testicle, bones, and serous cavities. I have a beautiful specimen which I removed from the deltoid muscle. Varying in volume between a mustard seed and a small orange, it is of a globular figure, of a whitish, semi-opaque appearance, and composed of a vesicle, or bladder, filled with serous fluid, and surrounded by a cellular-fibrous capsule, which thus isolates, and protects it from the circumjacent structures. It is usually gregarious, numbers of them inhabiting a common cyst, as seen in fig. 36; sometimes, however, there is only a solitary one, which is then commonly proportionably large. The contents of the animal are of a clear liquid character, remarkably saline to the taste, but destitute of odor and coagulability. The enclosing cyst is of a fibrous, or cellulo-fibrous structure, more or less vascular, and possessed of considerable strength. It is evidently a kind of adventitious membrane formed from plastic matter. Between this cyst and the parasite is commonly interposed a soft, pulpy, dirty-looking substance, the precise nature and object of which are not known. In consequence of their peculiar mode of generation, a large hydatid is sometimes found to contain several smaller, one within the other, like so many pill-boxes.

Fig. 36.

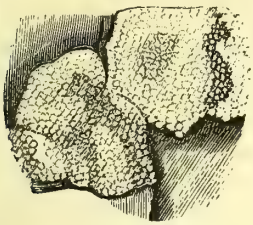


Hydatids inclosed in a common cyst.

Although the hydatid itself consists of two distinct layers, it is generally so weak and delicate as to break under its own weight when removed from its inclosing cyst, shrinking into a soft, pulpy mass, not

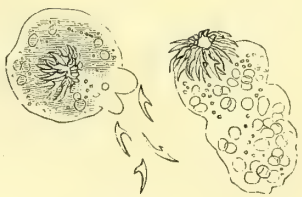
unlike the white of a hard boiled egg, both in appearance and chemical composition. To the inner surface of the parasite are attached numerous little bodies (fig. 37), hardly as large as a grain of sand, of a spherical shape, and of a grayish color, each consisting of a delicate cyst, filled with echinococci. These animals, which derive their origin and support from the hydatid, soon separate themselves, acquiring thus a sort of independent existence, great numbers being often seen floating about in the parent liquor when they are yet hardly the two-hundredth part of an inch in diameter.

Fig. 37.



Cysts of echinococci.

Fig. 38.



Echinococci.

Each echinococcus consists of a body and a head, the latter being encircled by a row of teeth. The body, which is composed of solid, granular matter, has a curiously speckled appearance, owing to the presence of numerous ovoid bodies immediately beneath its outer coat. The teeth are spinous, sharp, hook-like, and perfectly characteristic. They are not easily decomposed, and are therefore capable of affording important diagnostic information. The various appearances here described are well illustrated in the adjoining sketch (fig. 38).

Hydatids are usually short-lived, rarely lasting beyond a few years. Various causes may destroy them. Thus, some perish from suppuration, some from gangrene, some from the gradual drying up of their contents, and not a few from the pressure of their young. Under such circumstances, the inclosing cyst is often remarkably thickened, and even partially transformed into fibrous matter. I have seen cases where it had put on the appearance of the interior of an aneurismal sac. Great mischief, sooner or later, results from their presence, especially during the progress of their decay, nature often failing to eliminate them, and thus permitting them to excite violent irritation. A hydatid of the liver will occasionally induce fatal peritonitis, and the hardest structures, the osseous not excepted, are not always capable of withstanding its progress. A case has been reported of a parasite of this kind having perforated the scapula. In the lungs acephalocysts sometimes find their way into the bronchial tubes, from which they are afterwards ejected by expectoration.

There are no signs by which the existence of this parasite can be diagnosticated. Its presence in the discharges is the only reliable evidence of the kind. Some years ago I removed a small tumor from the arm, which had the character of an ordinary encysted formation, but which was unexpectedly found to contain an acephalocyst,

the animal rolling out upon the floor before I had extirpated the inclosing capsule. No treatment, except excision, is of any avail in this affection, and that, of course, is only admissible when the tumor is situated in an external and accessible part of the body.

12. POLYPOID TUMORS.

These are certain growths, long known to pathologists and practitioners, to which the term polyp, polypus, or polypoid has been applied, apparently from some fancied resemblance they bear to the form of the animal described under that name by naturalists. They are found exclusively in the mucous cavities of the body, where they often attain a large bulk, and become a source of serious mischief. Occurring at all periods of life, they are particularly common in middle-aged and elderly subjects, and present themselves in several varieties of form, differing essentially from each other in their structure and habits, if not also in their mode of origin.

The situations in which these growths are most commonly met with are the nose and uterus; they are also sufficiently frequent in the ear, the maxillary sinus, the vagina, and the rectum. In the larynx and throat they are rare, but not, perhaps, as much so as is commonly supposed. They are generally solitary, but occasionally considerable numbers occur in the same subject and even in the same cavity. Their volume varies from that of a small pea up to that of an adult's head, depending upon the nature of the tumor, the locality which it occupies, and the amount of resistance offered to its extension. Their shape, which is usually materially influenced by that of the cavity in which they are developed, is conical, pyriform, or globular, their attachment being generally effected by a narrow footstalk, root, or pedicle. Most of these growths belong to the class of benign structures, and hence the inconvenience which they occasion is chiefly of a functional character.

Polypoid tumors may conveniently be arranged under four heads, which, judging from personal observation, comprise all the known and generally recognized varieties, without including any of the subordinate divisions made by certain authors, and which are altogether dependent upon accidental circumstances. These are the gelatinoid, fibrous, granular, and vascular, which possess features sufficiently distinctive to entitle them to separate notice.

The *gelatinoid* polyp, the most common of all this class of morbid growths, rarely occurs in any other situation than the nose; it is, however, occasionally observed in the ear, larynx, vagina, and certain portions of the alimentary tube. As its name implies, it is of jelly-like appearance, looking, indeed, very much like an oyster, being of a soft, spongy consistence, and generally of an irregularly pyriform shape, with a narrow pedicle, sometimes nearly an inch in length. Occurring either singly or in clusters, it often completely closes the cavity in which it grows, although it rarely acquires much bulk; is destitute of sensibility; readily breaks under pressure; and is remarkably hygrometric, expanding in wet weather, and shrinking in dry. When pricked, a thin yellowish and slightly coagulable fluid exudes, which under the

microscope shows nucleated cells lying in a transparent blastema. The growth consists essentially of cellular substance supported by mucous membrane—a reflection from that of the part to which it is attached—and is nourished by a few straggling vessels, which are often of considerable length and thickness. When extirpated, it is remarkably apt to be reproduced.

The *fibrous* polyp owes its name to the peculiarity of its structure, which is of a dense firm character, the fibres interlacing with each other in every possible manner. In the recent state it is of a reddish, purple, or livid hue, but after maceration for a short time it exhibits a pale grayish aspect, and then displays its characteristic fibrous arrangement to great advantage. It is usually exceedingly tough, hard, and incompressible, offering great resistance to the knife, which emits a creaking noise as it is drawn through its substance. Although it has seemingly very few vessels, its removal is frequently attended with copious hemorrhage, both arterial and venous. Being nearly always solitary, it generally grows quite rapidly, often attaining a large bulk in a short time, and is usually attached by a broad base, not by a narrow pedicle, as is the case with the gelatinoid polyp. The most common habitations of this growth are the uterus, nose, and maxillary sinus. When extirpated, it has a tendency to recur; and cases are not wanting where it manifests a malignant disposition.

The *granular* polyp, found chiefly in the uterus and nasal fossa, is, on the whole, very uncommon, and seldom attains any great bulk. It is of a pale rose-color, grayish, or whitish; of a soft, fragile consistence; globular, ovoidal, or conical in shape; and from the size of a currant to that of a grape, its connection being usually effected by a long slender pedicle. Its structure is granular, homogeneous, and inelastic, looking, when cut, somewhat like a macerated salivary gland, and containing a small quantity of serous fluid. It has few vessels, grows slowly, and is easily detached, sometimes reappearing after extirpation.

The *vascular* polyp, occurring mostly in the ear, nose, uterus and rectum, is of a florid color, soft and spongy in its consistence, and usually attached by a narrow base. A section of it displays a cellular structure pervaded by numerous vessels, none of which, however, are of much volume, but still sufficiently large to produce copious hemorrhage when accidentally opened. The tumor, in fact, possesses many of the properties of the erectile tissue. Notwithstanding this, it seldom attains much bulk, and is generally slow in its progress, with little disposition to recurrence after removal.

We are hardly sufficiently familiar with the structure and functions of polypoid tumors to enable us to explain their origin. The probability is that most, if not all, take their rise in a species of hypertrophy of the tissues with which they are connected and from which they grow. Thus, the granular polyp apparently always begins in the mucous follicles of the part, which, as it expands, inveigles other structures, which thus serve to impart to it its distinctive features. In the vascular variety, the vascular element predominates, in the gelatinoid, the cellular, and in the hard, the fibrous. Whoever has examined a

fibrous polyp of the uterus must have been struck with its firm adhesions to that organ, and the perfect identification of its substance with that of the parenchymatous structure. Dr. Da Costa informs me that he has often found, in addition to fibrous tissue, muscular fibres and fibre-cells in this species of womb growth, rendering it thus highly probable that the fibrous polyp of this viscus is merely a species of hypertrophy of its proper substance. In the nasal fossa it is probable that this form of tumor always originates in the periosteum; at any rate, such a conclusion is plausible when we recollect that it is usually attached by a very broad base to the floor or septum of the nose.

These morbid growths are liable to various transformations, especially the fibrous, fibro-cartilaginous, cartilaginous and osseous; a circumstance which has induced some writers to make these changes the bases of so many additional divisions of these morbid products. They are, however, altogether accidental, and are seldom found except in cases of long standing. A more serious occurrence is the supervention of carcinomatous disease, if we concede the possibility that a structure, originally benign, may, during its march, take on malignant action. Without altogether denying such an occurrence, it must, to say the least, be extremely rare, and it would perhaps be more rational to conclude, in the absence of positive facts, that the tumor in most cases was primitively of a cancerous character, than that it became so during its progress. The fibrous polyp is more liable to this kind of degeneration or assumption than any other.

All polypoid tumors act obstructingly, closing the cavities in which they are developed, and thus interfering with the exercise of their functions. As they augment in size, they encroach upon the surrounding structures, pressing them out of shape, and causing more or less serious deformity. In this way, moreover, they may be productive of severe pain and great increase of the natural discharge of the part. In the nose and uterus they often give rise to serious hemorrhage.

The period of life at which these bodies appear varies according to circumstances. In the uterus they are most common in elderly females; in the nose, in young adults; in the rectum, in children; in the larynx, in advanced life.

No medical treatment of which we have any knowledge is of any avail in getting rid of these tumors. Sorbefacients, whether employed externally or internally, or both, are utterly useless. The only reliable remedy is extirpation, a proceeding which, if properly executed, rarely fails to afford at least temporary, if not permanent relief. In performing the operation it is important to effect complete clearance, since, if the least germ of the morbid product be left behind, repullulation will almost be inevitable. As it is, even with the best possible care, it is very difficult, especially in the gelatinoid variety of the affection, to prevent this occurrence. The methods of operation are torsion, ligation, and excision, of which the first should generally be preferred, as the least likely to cause suffering and hemorrhage. These procedures will be described in connection with polypoid tumours of different parts of the body.

13. MYELOID TUMORS.

The name of this tumor, which literally signifies marrow-like, was given to it by Mr. Paget, although its structure had been previously described by Lebert. It has been noticed in different parts of the body, but in particular in or upon bone, the mammary gland, uterus, cerebral membranes, the subcutaneous cellular tissue, and in the eyelids and conjunctiva; occurring in various sized masses, generally of a rounded, or ovoidal shape, and of a consistence varying from that of tallow or suet to that of fibro-plastic tissue. The cut surface has a smooth, compact, shining appearance, with blotches of a dark crimson, brownish, pink, or modena hue, either uniformly, or in various degrees of combination, all these tints being sometimes commingled. Much stress is laid upon these colors by pathologists as diagnostic characters of myeloid tumors, affording, as they do, the most ready external means of discrimination between them and other analogous formations.

A considerable quantity of fibrous, cellulo-fibrous, or fibro-plastic matter, generally enters into the morbid growth, presenting itself in the form of whitish, grayish, or yellowish filaments, scattered about irregularly, and frequently so arranged as to intercept small cells, filled with serum, sanguinolent fluid, or pure blood. Sometimes large cysts occur, similar to those which we find in tumors of the thyroid gland, and occupied by similar liquids. In the more recent specimens a section of the mass generally furnishes, on pressure, a small quantity of a thin yellowish fluid, altogether different from cancer-juice. When the disease is developed in the cancellous tissue of the bones, where its occurrence is more frequent than elsewhere, the tumor disparts the compact layers, forming a kind of cyst-like expansion, in which the new matter is lodged, and which, under such circumstances, often contains a large amount of osseous substance, soft, cellulated, of a reddish or pale yellowish tint, and easily recognized by sight and touch.

The minute structure of the myeloid tumor essentially consists of cells, nuclei, and nucleoli, imbedded in a finely granular matrix, and interspersed with filaments of fibro-cellular tissue. More or less fatty substance is frequently present, and the stroma is usually very vascular; a circumstance which readily explains the rapid development of this variety of morbid growth. Of the cells, as described by Paget, some are small, and of an oval, lanceolate, angular, or elongated figure, their contents being dimly dotted with single nuclei and nucleoli; others are round, oval, or flask-shaped, measuring from $\frac{1}{300}$ to $\frac{1}{1000}$ of an inch in diameter, and occupied each by nearly a dozen nucleolated nuclei. Intermingled with these corpuscles are free nuclei, of various forms and sizes, giving evidence of having escaped from the older cells.

The myeloid tumor is generally rather rapid in its growth, occurs in both sexes and at different periods of life, but more commonly in the young and middle aged than in the old, and is capable of attaining a considerable bulk. From its tendency to destroy effectually the structures in which it is developed, and from the fact that it occasionally displays a malignant tendency, recurring after extirpation, and ultimately causing death, there is strong reason to conclude that it is

generally merely a modified form of encephaloid or fibro-plastic growth. Nevertheless, we are not warranted, in the existing state of the science, in expressing a very positive opinion regarding the true nature of the disease. Further observation alone can afford any valuable clue to this.

Myeloid tumors furnish no diagnostic signs. They generally grow more rapidly than any other class of tumors, except the encephaloid, but their real nature can never be positively determined until after their removal. Of their treatment, or the influence of remedies in checking or arresting their progress, we are equally ignorant. When connected with the bones of the extremities, nothing short of amputation will of course hold out any prospect of relief, and even this is commonly very remote and uncertain. If excision be determined upon, the knife should be freely carried through the sound tissues, so as to guard as much as possible against relapse.

EXCISION OF BENIGN TUMORS.

To the above account of benign tumors may be appended, by way of practical precept, a few remarks respecting the proper method of removing these morbid growths with the knife.

1st. Interference should, as a general rule, be avoided when the tumor is stationary, or nearly so, painless, and not inconvenient by its size or situation.

2dly. If an operation be determined upon, the system should always be subjected to a certain degree of preliminary treatment, even when the tumor is comparatively small, experience having shown that extirpation is often followed by erysipelas.

3dly. While the object should be to effect the most thorough removal, care should be taken not to interfere unnecessarily with the surrounding tissues, but to respect them as much as possible by keeping the knife in close contact with the morbid growth.

4thly. If the tumor be of unusual bulk, it will generally be necessary to remove a portion of its tegumental covering, making, for this purpose, an elliptical incision; otherwise all the skin should be retained, due allowance being always made for its astonishing contractile powers. If this precaution be neglected, there may be a deficiency of flap when the surgeon comes to approximate the edges of the wound.

5thly. Diseased integument should always be removed along with the morbid growth.

6thly. In general, extirpation may be effected by a single incision, carried across the centre of the tumor, either vertically, or in a curvilinear direction. It is only when, as already stated, the morbid growth is very large, that an elliptical incision will be required.

7thly. Care should be taken, in making the incisions, to give them such a direction as shall favor drainage, or prevent bagging. Hence, one of the extremities should always correspond with the most dependent portion of the tumor.

8thly. By keeping the knife in close contact with the tumor, it may sometimes be promptly and effectually enucleated with the hand,

finger, or scalpel. Another advantage resulting from the observance of this precaution will be the avoidance of hemorrhage.

9thly. Any large arteries that may be divided should either be compressed by an assistant until the extirpation is completed, or they should immediately be tied, loss of blood being carefully guarded against in all operations of this kind.

10thly. When all oozing of blood has ceased, the edges of the wound are accurately approximated by suture and adhesive strips, aided, if necessary, by a light compress and bandage, to keep the flaps in close contact with the raw surface beneath; the object being to secure union by the first intention.

11thly. The part is always to be kept perfectly at rest until the wound is healed; the case being treated in every respect upon ordinary antiphlogistic principles. In general, the dressings should not be disturbed before the end of the third day, especially if the absence of fetor and discharge indicates that everything is progressing favorably.

SECT. III.—MALIGNANT TUMORS.

Under the term malignant are comprised certain morbid products which have the effect, within a variable period after their formation, of destroying not only the tissues in which they are deposited, but also the life of the patient. The pathological anatomist usually describes them under the name of the heterologous, heteroclite, or heteromorphous products, in reference to their want of similarity to the natural structures, but the prefix malignant is justly applicable to them, on account of their destructive disposition. The formations which are usually embraced under the present head are scirrhus, encephaloid, colloid, melanosis, and cancroid, the latter having been only lately added to the list as a distinct affection. From this catalogue tubercle is usually excluded, although it is by far the most common as well as the most destructive of all the heteromorphous developments, especially when it occurs in the lungs and serous membranes. In the external parts of the body, however, it is less so, and hence, perhaps, the reason why surgical writers generally exclude it from this position. It would greatly simplify the study of these affections if the term "cancer," by which some of them continue to be designated, were altogether discarded from surgical nomenclature. This expression, introduced in the infancy of the science, is entirely figurative, and therefore calculated to mislead the mind of the inquirer.

These various morbid formations, although they differ widely in many of their characters, yet possess certain features in common with each other, which may be briefly enumerated before we proceed to speak of them individually.

1st. They are all deficient in plastic material, while they contain an unusual amount of albuminous substance, or the protein principles of the blood. The consequence is that they are less organizable than the ordinary lymph-products, and also less capable of maintaining a long existence in the parts among which they are deposited.

2dly. Under the microscope they are found to consist of two parts, a fibrous stroma, and granules or cells, which bear to each other the relation of containing and contained parts. The former is either of new formation, or it is composed of pre-existing tissue, in an altered state. The cells often contain nuclei and nucleoli, and possess, in many cases, an astonishing multiplying faculty; a circumstance which adds greatly to the rapidity and malignancy of the morbid growth.

3dly. They occur in nearly all the organs and tissues of the body, in both sexes, at all periods of life, in all temperaments, and in persons of all occupations, often existing simultaneously in a number of localities. They frequently display a marked hereditary tendency, often forming at or soon after birth, and also a disposition to appear in several members of the same family.

4thly. They present themselves under different varieties of form; generally as a distinct, circumscribed tumor, but very frequently also as a stratum, or infiltration.

5thly. They are all deposited, as a secretion, in a fluid form, but soon assume a concrete character, which, after a time, they again, in part, lose, their tendency being to become disintegrated, and to work their way to the surface, by exciting ulcerative action in the surrounding tissues. The resulting sore is incapable of forming healthy matter and healthy granulations; or, in other words, it remains open and intractable, either for an indefinite period, or until the patient perishes from the effects of the local and constitutional irritation.

6thly. They are all of constitutional origin, or connected with a contaminated state of the blood and solids, a perfectly healthy individual being incapable of their attack, which generally takes place without any assignable cause. Owing to this circumstance, they always manifest a tendency to reappear after extirpation, either at the original site, or at some other point.

7thly. Their progress is generally rapid, most of them causing death in from nine to eighteen months from the time of their first appearance. As they advance, especially when ulceration is about to begin, they involve the neighboring lymphatic ganglions, transmitting to them, through the agency of the absorbents, some of their own material, or exciting similar disease by sympathetic irritation.

1. SCIRRHUS.

The term scirrhus is employed to designate a morbid product which is more dense and firm than any of the natural tissues, excepting tendon, cartilage, and bone. Hence it is often called hard cancer, an expression which was applied to this substance in the infancy of the science, from some fancied resemblance which it was supposed to bear to the claws of that animal. It is to be regretted, as already stated, that it is not altogether abolished from surgical nomenclature, as its retention is only calculated to add confusion to a subject unfortunately sufficiently obscure.

The occurrence of scirrhus is as frequent as its character is malignant and unforgiving. It is observed at various periods of life, but rarely until after middle age. The youngest subject in which I have

ever seen the disease was a mulatto child three months old, whose case has been reported by Dr. S. W. Gross, in the North American Medico-Chirurgical Review for May, 1857. It presented itself in the liver, which was otherwise perfectly healthy, in the form of white tubercles, which were of a firm, almost fibro-cartilaginous consistence, and exhibited under the microscope all the characteristics of genuine scirrhus. Scirrhus of the skin is also occasionally observed at a comparatively early period; but everywhere else it is rare until after the age of forty, when it becomes sufficiently common. The period of its greatest frequency is from the forty-fifth to the fifty-fifth year.

Females are more liable to scirrhus than males, but in what precise proportion has not been ascertained. The influence of temperament, habit, and occupation upon the production of the disease also remains undetermined. It is generally supposed that persons of a dark bilious temperament are particularly subject to it, but for such an opinion there is no valid reason.

Certain organs and tissues are more prone to scirrhus than others. Thus, what are called the glandular viscera, as the liver, mamma, and uterus, are particularly liable to suffer, though the testicle, which belongs to the same class, is singularly exempt from the disease, so much so, indeed, that we may well question whether it is ever attacked by it. The stomach, anus, rectum, and colon are often invaded in both sexes. Scirrhus was supposed at one time to be very common in the lip and penis, but recent researches tend to show that this is not the fact, but that the affection, formerly so regarded, is nothing but epithelial cancer, a milder form of malignant structure. Whether this, however, is really so, future observation must decide. Meanwhile, it is positively certain that cancroid disease is often much more rapidly fatal than scirrhous. The bones, muscles, tendons, ligaments, aponeuroses, vessels, nerves, salivary glands, brain, lungs, spleen, and urinary organs are nearly entirely exempt from this heterologous formation.

Like the other heteromorphous products, the scirrhous may appear under several *varieties of form*, as the tuberoid, stratiform, and infiltrated, of which the first is the one, surgically speaking, of the greatest interest. The other two occur chiefly in the internal organs, particularly the œsophagus, stomach, colon, and rectum, the submucous cellular tissue of which they often so completely transform as not to leave a vestige of the original structure; at the same time that they encroach very seriously, if not fatally, upon the caliber of the tube. The affected part is dense and crisp, cutting almost like fibro-cartilage, and has a pale yellowish or grayish appearance, with white fibrinous intersections. The stratiform variety is occasionally met with in the skin and subserous cellular tissue, but the occurrence is uncommon. Scirrhus of the uterus generally presents itself as an infiltration.

The best example of the tuberoid variety occurs in the mamma and liver; it is also sometimes seen upon the serous membranes and in the skin, or in the skin and subcutaneous cellular tissue, in the form of little nodules, often not larger than a currant, a pea, or a filbert. Sometimes the tumor consists of one single mass, as in the liver, but more generally it is made up of several, which together may form a

growth as large as an orange, or even a fist, hard, dense, inelastic, and almost incompressible, grating under the knife, of variable shape, but generally globular or ovoidal, movable, and deeply inlaid in the tissues among which it is situated. These tissues occasionally afford the tumor an imperfect capsule, but in general there is no such investment, the heteroclite matter being often spread out in the most irregular and grotesque manner, like the claws of the animal from which the disease has derived its generic name. The fibrous intersections which pervade the interior of the morbid mass are the remains of the normal tissues, variously changed by the disease. They are generally of a dense, firm consistence, and of a grayish, bluish, or rosaceous color, thus strikingly contrasting with the abnormal deposit. It is questionable whether the fibrous bands, as they are commonly called, are ever entirely of new formation. In the mammary gland they generally consist of imprisoned lactiferous tubes.

Structure.—A section of a scirrhous tumor, especially in its more matured stages, exhibits a whitish, homogeneous aspect, and affords, upon being scraped, a peculiar lactescent fluid, somewhat unctuous to the touch, which has received the name of *cancer-juice*, and upon which much stress has been laid by modern pathologists as denotive of malignancy. It is seldom present in very recent specimens, and my researches have led me to believe that it is a result of partial softening of the heteromorphous mass, preparatory to ulceration. We sometimes find it united with a considerable quantity of free oil.

Scirrhus has a very feeble circulation, its vessels being remarkably small, and probably wholly derived from the surrounding parts. Of their precise arrangement, however, we have no definite idea. The paucity of vessels affords a satisfactory clue to the slow growth and comparatively small size of the morbid product, and a reason, also, why there is so seldom any considerable hemorrhage after ulceration has set in. No nerves have been demonstrated in its substance, but their free distribution is inferred from the sharp, lancinating pain which forms so characteristic a symptom of the disease. Lymphatics also exist; as is proved by the fact that if arsenic be applied to an open scirrhous ulcer, it is often absorbed into the system, producing similar effects as when taken directly into the stomach.

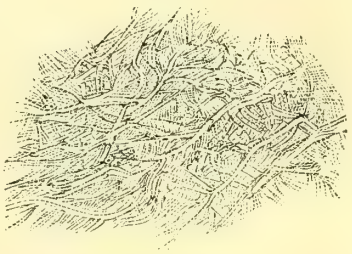
Pathologists have laid much stress upon the existence of certain subdivisions of scirrhous tumors, as the mammary, pancreatic, lardaceous, and reticular, as if the appearances which these expressions are intended to designate were not purely accidental, depending upon the character and amount of pre-existing tissue, the age and mode of aggregation of the heteroclite matter, and, above all, the state of the patient's general health. I must object the more strenuously against the use of these terms, because they have only a tendency to complicate the subject and create confusion. I am sure that, with all my opportunities for observation, I have never seen a scirrhous tumor to which the word mammary or pancreatic could be applied with any degree of propriety; and I am equally certain that the lardaceous and reticular varieties, as they have been termed, although they may sometimes present a faint resemblance to the objects after which they have been named, must be exceedingly rare.

Chemically examined, scirrhus is found to consist largely of albumen and fatty matter, the two together forming more than one-half of the entire mass. In a specimen of scirrhus of the uterus, analyzed by Hecht, the fatty substance amounted to fifty per cent. Fibrin exists sparingly in all cases. Gelatine is said to be occasionally present, but this is questionable. In an examination by Foy, upwards of thirty per cent. of earthy salts existed, fully one-half of this quantity being in the form of subphosphate of lime.

The facts which chemistry has revealed in regard to the composition of scirrhus are valuable, as showing that this substance is formed of materials very much of a non-plastic character, and consequently incapable of resisting, for any length of time, the influence of surrounding agents. It is reasonable to suppose that its composition is not alike in all cases, but that it is greatly influenced by the site and age of the morbid product, and, therefore, that it varies not only in different stages of the malady, but also in different portions of the same specimen.

The *minute structure* of scirrhus consists of two parts, a fibrous network, and a soft granular matter. The former is made up of filaments, of a whitish or grayish color, which, intersecting each other in every conceivable direction, form meshes, of variable shape and size, for the lodgement of the granular element. These filaments, which are well shown in the annexed cut (fig. 39), are of a fibrous structure and generally consist, not of new matter, but merely of pre-existing tissue, condensed and altered by the heteroclite deposit. Their appearance is occasionally very distinct in recent specimens of scirrhus, especially of the liver and mamma, but ordinarily it is necessary to scrape away the granular matter before they can be brought into full relief.

Fig. 39.



Stroma of scirrhus.

The essential element of scirrhus, contained in the meshes of the fibrous structure, consists mainly of cells and free nuclei, lying in a transparent and slightly granular matrix. The cells vary much in shape; some being round, some oval, and others, again, caudate, or furnished with tail-like prolongations. In size they range from the $\frac{1}{600}$ to the $\frac{1}{1700}$ of an inch in diameter, most of them being large and well defined, especially in the more matured specimens of the disease. They have each a delicate, but distinct wall, and generally inclose one or more nuclei. The nuclei are, for the most part, of an oval shape, and often, in turn, inclose well-marked

Fig. 40.



Scirrhus cells.

nucleoli. Sometimes the nuclei escape from their cells, and scatter themselves through the uniting substance as if in search of new homes. Finally, crystals, granules, oil-drops, and old, degenerated cells are often found in the same specimen under the field of the microscope. The various forms of cell-formation are well shown in the accompanying cut (fig. 40), from a drawing by Dr. Da Costa.

Progress.—The progress of scirrhus is generally more slow than that of the other heteromorphous deposits, both as it respects its tendency to ulceration and the destruction of life. It is seldom that a scirrhous tumor of the breast becomes an open sore under twelve, fifteen, or eighteen months; not unfrequently, indeed, several years elapse before it takes on this kind of action. I had at my Clinic, two winters ago, an elderly lady, formerly a patient of Sir Astley Cooper, in whom the disease had been regularly progressing for more than twenty years before any disposition to ulceration became apparent. Several other cases, somewhat less in their duration, have been under my observation. In general, however, the tendency to ulceration shows itself within the second year, commencing usually in a superficial portion of the tumor, sometimes at one, and at other times at several points, the process being preceded and accompanied by more or less discoloration of the surface, and by the adhesion of the skin to the subjacent parts. The color is always dark, purple, or livid, the vessels immediately concerned in its production being enlarged and deeply congested, frequently presenting an appearance as if they were inlaid in the cutaneous tissues. The part at length giving way, an unsightly ulcer is exposed, having hard, steep, and rounded edges, and a foul-looking bottom, generally incrusted with spoiled lymph. The discharge is always of a sanious, ichorous, or sanguinolent nature, more or less fetid, irritating, and often remarkably profuse. It tarnishes silver, imparts a green color to syrup of violets, and, on admixture with sulphuric acid, evolves a peculiar gas, having many of the properties of sulphuretted hydrogen. No granulations ever form upon such an ulcer; hence it never heals, the plastic matter which it secretes losing its vitality as soon as it is deposited. There are, of course, exceptions to this rule; but they are very uncommon, and I have never met with any. Sometimes the scirrhous ulcer has a remarkably excavated appearance, as if it had been dug out with a punch. The parts immediately around the ulcer are always very tender, discolored, and œdematous.

Another tendency of the scirrhous tumor is to contract adhesions to the structures among which it is situated. This disposition, which often manifests itself at a comparatively early period, is always very conspicuous in the latter stages of the malady. The immediate cause of the adhesions is an effusion of ordinary plastic matter; but in some cases, especially in such as are of long standing and of unusual size, they are owing, at least in part, to the heteromorphous deposit itself, which, under such circumstances, often breaks through its original boundaries into the skin, cellulo-adipose tissue, muscles, glands, and even bones, involving them all in one common mass.

But a tumor of this kind not only involves the parts with which it

lies in immediate contact, but it often extends its influence to others further off. The structures which are most liable to suffer in this way are the lymphatic ganglions, which often take on the same kind of action, becoming enlarged and indurated, and exhibiting, on division, precisely the same appearances as the original tumor. Sometimes, again, parts still more remote become involved in the morbid action. Thus, in scirrhus of the mamma we often see not only great contamination of the axillary lymphatic ganglions, but serious swelling of the corresponding arm, evidently from an extension of the primitive affection.

Thus the tendency of this disease is to spread and to contaminate the surrounding structures, making itself deeply felt not only at home but abroad; not merely locally but constitutionally. In exceptional cases, the morbid influence is closely circumscribed, limiting itself, perhaps, for years, to the spot in which it originally appeared; but even then it eventually breaks through its barriers, and spreads among the surrounding parts. Finally, after having inhabited the part for a time, nature occasionally makes an effort at extrusion, the tumor being invaded by gangrene, and at length detached as a slough. Such an occurrence, however, is extremely rare. I have seen but one instance of it. The patient was an elderly lady, fat, and otherwise healthy, who had a medium-sized scirrhous tumor in one of the mammary glands which had troubled her for several years. All of a sudden, without any assignable cause, inflammation set in, and in a few weeks the whole mass was lifted from its bed as neatly as if the operation had been performed with the knife. Some time afterwards the disease broke out in the axillary lymphatic ganglions, and made rapid strides towards a fatal termination.

Symptoms.—The symptoms of scirrhus necessarily resolve themselves into local and constitutional. The former can only be satisfactorily studied as they appear in an external tumor, such, for example, as that which involves the mamma. In taking hold of such a tumor we are struck with its extraordinary hardness and density; it feels firm, incompressible, and inelastic. If it be of recent origin, it will be found to be perfectly circumscribed and movable, the examiner being able to grasp it with the fingers, and to push it about beneath the skin; at a later period, however, it contracts adhesions to the surrounding parts, and thus becomes firmly fixed in its situation. The morbid product may appear as a solitary tumor, or several little lumps may appear simultaneously or successively, and, gradually coalescing, a considerable sized mass may thus be formed.

The pain of scirrhus is peculiar. It is sharp and lancinating, darting through the parts like an electric spark, or causing a sensation as if needles were thrust into them. It makes its appearance at an early date, gradually increasing in severity, and becoming at length a source of intense suffering. It may be steady and persistent, but more generally it is intermittent, coming and going apparently as whim or caprice may dictate. It is always aggravated by damp states of the atmosphere, and by whatever has a tendency to impair the general health. In some cases we find it to be of a neuralgic character; and

under such circumstances, instead of being limited to the morbid mass, it often shoots about in different directions among the neighboring structures. During the latter stages of the disease it is generally so constant and violent as to deprive the patient of sleep and appetite, thus rapidly urging on the fatal issue.

During the progress of the disease the skin is tied down to the morbid mass, and soon becomes hard and livid, its vessels being at the same time very much enlarged and deeply congested. Presently ulceration sets in, the resulting sore having a steep excavated appearance and a foul discharge, without the ability to form granulations, to produce healthy pus, or to undergo reparation. The tumor is now firmly adherent to the surrounding structures, and there is generally, though not invariably, lymphatic involvement. A discharge of blood sometimes attends the ulcerative stage, but it seldom exceeds a few drachms, or, at most, a few ounces. The bleeding may be purely capillary, or it may proceed from a tolerably large vessel, arterial or venous, laid open by the morbid action, and unable to retract in consequence of the condensation of the circumjacent tissues.

Scirrhus, in its earlier stages, produces little or no constitutional disturbance. The affection is strictly local, annoying and fretting the parts directly involved in it, but not awakening any general sympathies. A little mental disquietude, the result of the consciousness that there is a suspicious tumor or lump, is the only thing that excites attention. By and by, however, the health begins to fail; the appetite is impaired; the sleep is interrupted by the severity and frequency of the pain; the secretions are disordered, and some of them are, perhaps, entirely suppressed; the bowels are irregular; the assimilative functions suffer; occasional attacks of fever take place; the flesh and strength gradually decline; the spirits are depressed; and life is beset on every side by the treacherous and unrelenting enemy. During the latter stages of the malady, sometimes even before there is any serious lymphatic involvement, the countenance assumes a peculiar sallow, cadaverous expression, so denotive of the cancerous cachexy; diarrhœa and sweats set in; the limbs become anasarcous; and at length the patient dies utterly exhausted, being literally pricked, fretted, and stung to death by the disease.

During the progress of this disease scirrhous deposits often appear in other parts of the body; the blood becomes thin and colorless; and the solids are emaciated, pale, and flabby. Even the bones often experience important changes, especially those of the thigh, which are sometimes rendered so fragile as to give way from the slighest cause. Many years ago I had under my charge, on account of scirrhus of the mamma, an old lady of seventy-three, who broke her right femur a few days before she died, simply by turning round in bed.

2. ENCEPHALOID.

Although encephaloid and scirrhus closely resemble each other in their structure and composition, yet they exhibit sufficiently distinctive features to justify us in considering them as different diseases.

As the progress of morbid anatomy advances, we shall doubtless become more enlightened in regard to their intimate relations, and also in regard to the relations which they sustain towards the tissues in which they occur, as well as to the system at large.

Encephaloid has various synonymes, of which the most common are, soft cancer, medullary sarcoma, cerebriform cancer, and fungus hematodes. Mr. John Burns, of Glasgow, who was the first to describe it, gave it the name of spongoid inflammation. All these various appellations have reference either to the appearance, consistence, or structure of the morbid product, and are therefore more or less appropriate. That of encephaloid, however, is, on the whole, the least objectionable, and is the only one that ought to be retained. There is a form of the disease, to which attention was first called by Mr. Hey, of Leeds, under the name of fungus hematodes, which I shall designate as the hematoid variety, and which, in my judgment, is the only one that deserves separate consideration. The terms solanoid, napiform, and reticulated, devised by some of the French and German pathologists, to specify particular states of encephaloid, ought to be discarded from the nomenclature of disease, as they are only calculated to lead to confusion by keeping up a refinement which does not exist in nature.

Although this disease occurs in various organs and tissues, yet it is by far more common in the mamma, eye, testicle, uterus, liver, lymphatic ganglions, periosteum and bones, than anywhere else. With the exception of the muscles, tendons, nerves, cartilages, ligaments, and aponeuroses, there is no part of the body in which it has not been sometimes observed. Occasionally it takes place, either simultaneously or successively, in a considerable number of structures, resembling, in this respect, the other heteromorphous products, and constituting a genuine encephaloid diathesis. It appears in both sexes, and at all periods of life, from early infancy to old age, but the greatest number of cases occur between the twentieth and fiftieth year. The subjoined table constructed for me by Dr. Cassot, shows the age in ninety-one cases.

Years.	No. of cases.	Years.	No. of cases.
1 to 3	8	30 to 40	14
3 " 7	4	40 " 50	18
7 " 14	5	50 " 60	7
14 " 21	9	60 " 70	4
21 " 30	20	70 " 75	2

The *localization* of encephaloid is materially influenced by the age of the patient. Thus, in the mamma the disease is almost peculiar to middle age; in the testicle, to young adults; in the eye, to childhood. Of the relative frequency of the disease in the two sexes, we have no reliable data. In the cases analyzed by Dr. Cassot, there was a predominance of males, and in my own practice I have certainly seen it oftener in men than in women; but this may have been a mere coincidence.

The *chemical* composition of encephaloid, as determined by the analysis of Mons. Foy, probably the most accurate that has yet been made, shows the greatest possible resemblance to that of scirrhus by

the same chemist. To enable the reader to compare the results of his examinations I shall subjoin his two tables in parallel columns:—

Encephaloid.		Scirrhus.	
Albumen	47.00	Albumen	42.00
White fatty matter	7.50	White fatty matter	5.00
Red fatty matter	5.35	Red fatty matter	3.25
Osmazome	4.00	Fibrin	5.85
Fibrin	6.50	Water	5.00
Water	8.00	Oxide of iron	1.65
Oxide of iron	1.35	Sub-phosphate of lime	16.60
Sub-phosphate of lime	6.30	Carbonates of Soda	5.00
Carbonates of Soda	2.75	Carbonates of Lime	6.60
Carbonates of Lime	4.00	Carbonates of Magnesia	0.85
Carbonates of Magnesia	1.00	Hydrochlorates of Potassa	4.10
Hydrochlorates of Potassa	2.70	Hydrochlorates of Soda	3.25
Hydrochlorates of Soda	2.00	Tartrate of soda	0.85
Tartrate of soda	0.35		100.00
	100.00		

It will thus be perceived that the chief differences in the composition of the two substances consist in the presence of osmazome in encephaloid, in the lesser quantity of earthy salts, and the greater quantity of albumen. The fibrin exists in nearly equal proportions. The analyses make no mention of gelatine, which has been asserted by certain chemists to exist in both substances, especially in the more recent specimens. Doubtless, the composition of encephaloid is greatly influenced by the age and site of the deposit, the general health of the patient, the condition of the blood, and even by different portions of the same tumor.

The similarity of the minute *structure* of the two products is hardly less remarkable than that of their chemical constitution. Most specimens exhibit, under the microscope, a stroma and corpuscles, closely resembling those of scirrhus. The stroma, or basis-structure (fig. 41), is made up of a fibrous substance, not equally well developed in every specimen, but in general sufficiently distinct to admit of easy recognition. The firmer varieties usually contain two kinds of fibres, both hollow, but one is opaque and granular, the other hyaline and studded with cells and nuclei. The other element, the essentially cancerous substance, consists of corpuscles, of a rounded, ovoidal, or caudate shape, exactly similar to those of scirrhus, only that the latter arrangement is commonly more distinctly marked. Nearly all include large, oval nuclei, and not a few also nucleoli. Besides these two substances, most specimens contain pigment matter, granules, and oil globules. The various forms of cancer corpuscles are well displayed

Fig. 41.



Stroma of medullary carcinoma.

in the annexed cut (fig. 42). The caudate bodies are particularly distinct.

In regard to its arrangement, the encephaloid matter presents itself under three *varieties of form*, as a tumor, a stratum, and an infiltration,

Fig. 42.



Elongated and caudate cells from an encephaloid tumor.

the first being the most common, and, surgically considered, the only one of any particular interest. It varies in volume from that of a pea to that of an adult's head, its shape being generally somewhat ovoidal, and its surface more or less lobulated (fig. 43). Its configuration, however, is always greatly influenced by the amount of pressure exerted upon it by the parts in which it is situated, and hence it is occasionally very much flattened, or irregularly compressed. When seated in the external structures, as in the subcutaneous and intermuscular cellular tissue, over the bones, in the mammary gland, and in the lymphatic ganglions, it has generally a well-marked cyst, of a grayish, whitish, or rosaceous appearance, and of considerable firmness and thickness, which thus serves to define its limits and to isolate it from the original textures. Extending from the inner surface of this envelope are numerous processes, which, passing through the interior of the diseased mass, intersect each other in various directions, and thus form cells, cavities, or lodges, for the accommodation of the new matter, just as in scirrhus, only that they are generally larger and more fully developed. The encephaloid matter, freed from its stroma, or fibrous

Fig. 43.



Tuberoid form of encephaloid.

element, is of a soft, jelly-like consistence, very much like that of the fœtal brain, viscid to the touch, of a whitish or slightly reddish tint, miscible with water, of a peculiar sperm-like odor, and readily coagulable by heat, alcohol, and acids, thus showing its protein character.

If a section be made of an encephaloid tumor, it will be found to present, in most cases, not a little variety of form, or diversity of appearance and consistence. Thus, one part may be soft and white, like brain, another perhaps feel, look, and cut like fibro-cartilage, while a third may be composed essentially of a reddish semi-concrete substance, bearing a striking resemblance to the contents of an old aneurism. Most of these differences are due to the age of the tumor, and the changes experienced by the included primitive tissues; but the latter are so distinct and peculiar as to entitle them to be considered almost as a separate formation. It is to this morbid product that, as was before stated, the term *hematoid* ought to be applied, as expressive of its blood-like structure. It looks, in fact, more like a mass of firmly coagulated and semi-organized blood than any other substance to which I can compare it. Occasionally a more solid substance is mixed up with the hematoid, as the fibrous, or fibro-cartilaginous, and when this is the case it generally creaks under the knife, cutting a good deal like a raw turnip, or the rind of bacon. I have found this form of tumor most commonly in the mamma, liver, testicle, and lymphatic ganglions, the latter of which, when thus affected, occasionally exhibit a singularly areolar structure, a section bearing a close resemblance to the surface of a sponge, the cells being occupied by the hematoid matter.

Encephaloid sometimes, although rarely, occurs as an infiltration, chiefly in the lungs, liver, uterus, and lymphatic ganglions, the proper structure of which it subverts and ultimately completely effaces, forming a dense, solid mass, of a pink, grayish, or ash color, grating under the knife, inelastic, and almost incompressible. The stratiform variety is also uncommon. It is seen chiefly in the submucous cellular tissue of the stomach and rectum, and beneath the pleura and peritoneum, in small, thin, whitish patches, from the diameter of a dime to that of a dollar.

Encephaloid, being an extremely vascular structure, is endowed with a high degree of vitality, growing generally with great rapidity, and often attaining an uncommon bulk in a few months from its first appearance. Its vessels are unusually large, and are probably derived from the pre-existing tissues, although cases occur where the circumstances are such as to lead to the belief that they are now and then created, at least in part, by the heteroclite matter itself. If such a conclusion be admissible, as I think it is, then it follows that encephaloid has occasionally, like plastic lymph, a double circulation, one peculiar to itself, and the other common to it and the tissues with which it lies in contact. Be this as it may, the vessels are generally remarkably voluminous, thus strikingly contrasting with those of scirrhus, at the same time that they afford a ready explanation of the differences in the rapidity and size of the two formations. Their walls also are unusually brittle, and hence they are liable to give way under

the most trifling causes, producing those apoplectic depôts which we so often see in their interior, and those frightful hemorrhages which occasionally attend their open condition.

Of the absorbent vessels of encephaloid nothing special is known. Doubtless, however, they exist in large numbers, otherwise it would be difficult to account for the facility with which morphine and other articles, applied to encephaloid ulcers, find their way into the general system. Nerves are also probably freely distributed through the morbid mass, although it is a singular fact that this disease is generally much less painful than scirrhus. The reason, however, is not the paucity of nerves in the one, but the manner in which they are compressed in the other, the structure of encephaloid being so much softer than that of scirrhus, and therefore admitting of greater comfort to its nerves.

It is not unusual for encephaloid tumors to contain serous cysts, as well as other adventitious products, thus complicating their structure, and occasionally throwing a doubt over their diagnosis. In general, the cysts are small; but I recollect an instance where a cavity of this kind contained fully a pint of serum, its walls having a peculiar honeycombed appearance. Apoplectic depôts, as already stated, are most common in the hematoid variety of encephaloid tumors.

It is seldom that an encephaloid tumor, after having once gotten fairly under way, remains even temporarily stationary; on the contrary, its tendency is to proceed, steadily and regularly, in its work of disorganization, until it destroys life either by hemorrhage or by irritation, the period at which this takes place varying, on an average, from nine to twelve months. Death sometimes occurs in an almost incredibly short time. I remember the case of a young lad, a patient of Professor Post, in the New York Hospital, who had a large encephaloid tumor upon the scapula, from which he died in less than eight weeks from its first appearance. On the other hand, a patient occasionally lives several years. Great softness of texture, bulk, and rapidity of growth are the circumstances which particularly predispose to an early unfavorable issue.

The period at which the encephaloid tumor becomes an open ulcer is indefinite; sometimes it takes place within a few months, at other times not under a year, or a year and a half, although this is uncommon. The immediate cause of the ulceration may be the pressure of the morbid mass upon the skin, the formation of an abscess, or the occurrence of a slough. However this may be, the sore is always characteristic. Its edges are thin, undermined, jagged, or irregular, and its bottom, which is sometimes of considerable depth, has a foul, bloody, fungous appearance. In some instances it is covered with numerous excrescences, or large fungous granulations, giving it a peculiar cauliflower-like aspect. The parts immediately around are of a deep red, livid, or purple color. The discharge is usually profuse, and of a sanious, bloody, or sanguinolent character, a development of pure laudable pus never being seen. Copious hemorrhage occasionally takes place, especially in the hematoid variety of the disease, and by its frequent repetition often rapidly undermines the general

health, urging on the fatal crisis. The occurrence is particularly common in encephaloid of the eye, uterus, and mamma. Of the many cases that I have seen of the encephaloid ulcer, I have never known one to heal even temporarily. Intractability is one of its distinguishing features.

Lymphatic involvement often occurs at an early stage of the disease, sometimes long before ulceration sets in; at other times, however, it does not take place until the tumor has opened. As a general rule, it may be stated that the more rapid the growth is the earlier will there be disease in the neighboring ganglions, and conversely. The constitutional cachexy is always well marked in the more advanced stages of the affection, and the patient's doom is often depicted in legible characters upon his countenance several months before it is finally sealed in death.

An encephaloid tumor is distinguished by its comparative softness, by the rapidity of its growth, by its great bulk, and by its lobulated surface. The pain is generally slight, at least until ulceration takes place; and there is nearly always considerable, sometimes enormous, enlargement of the subcutaneous veins. In its earlier stages, the tumor is movable, as in scirrhus, but as it advances it contracts adhesions, and at length becomes permanently fixed.

3. EPITHELIOMA.

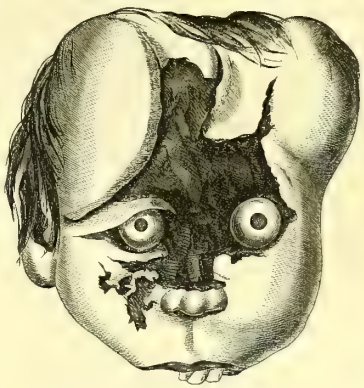
There is a class of affections which were formerly known under the name of scirrhus, from their supposed identity with that disease, but which modern research has shown to be so different from it as to entitle them to be regarded as separate formations. They comprise the various forms of malignant disease of the cutaneous and mucous tissues, more particularly carcinoma of the lip, gums, tongue, face, anus, and penis. They are not, however, limited to these parts; for they sometimes invade the deeper structures, as the bones, muscles, lymphatic ganglions, liver and lungs, although their occurrence here is very infrequent. The names by which these formations are now generally designated are epithelioma, cancroid, and epithelial cancer, which, as they are sufficiently expressive of their true character, may all be appropriately used as fancy may dictate.

Epithelioma is more common in men than in women, the latter being more liable to scirrhus. In the male the lip and penis are most frequently attacked. What is called chimney sweeper's cancer is merely a form of epithelial disease of the scrotum. Lupus, the *noli me tangere* of the older writers, is nothing but cancroid of the skin of the face, an affection sufficiently common in both sexes, and often committing the most frightful ravages. In whatever form it may appear, it seldom shows itself before the age of thirty-five or forty. Another circumstance worthy of note is that the disease usually occurs only in one part of the body, its origin being apparently much less connected with the constitution than that of the other varieties of carcinoma.

The *causes* of this disease are not well understood. Sometimes it

is directly traceable to external injury, as long-continued pressure. Thus, Dr. Da Costa has mentioned to me the case of a shoemaker, where it was clearly attributable to the effects of a small board worn habitually upon the abdomen while the man was working at his trade. Epithelioma of the lip is often charged, whether correctly or not I will not pretend to determine, to the irritation produced by the pipe in smoking. Chimney sweeper's cancer is generally ascribed to the irritation occasioned by the lodgement of soot in the folds of the scrotum. Sometimes the disease originates in a wart or cicatrice. Epithelioma of the penis, until lately regarded as true cancer, has been very commonly ascribed to the irritation arising from the want of cleanliness from the existence of a long and tight prepuce. A sharp tooth, brought constantly in contact with the tongue, is, as is supposed, an exciting cause of epithelioma of that organ. Cases have been collected which tend to prove that the disease occasionally manifests a hereditary predisposition. Dr. Foster, of Terre Coupee, Indiana, has communicated to me the particulars of three cases which occurred in three members of the same family, two having died from epithelioma of the face, and one from epithelioma of the foot.

Fig. 44.



Epithelial cancer in a state of ulceration.

Cancroid generally begins in the form of a tubercle, crack, or wart-like excrescence, hard to the touch, movable, and somewhat tender on pressure. As the disease advances the part extends in different directions, and becomes more defined in its character. By and by ulceration sets in, sometimes almost simultaneously at several points, the exposed surface having a foul, unhealthy, fungating appearance, with irregular granulated edges, and a hard rough base. The discharge is generally abundant, and of a thin, sanious, acrid description, often eroding the skin in the neighborhood. The ulcer is intractable, manifesting no disposition to heal, or, if granulations should form, they speedily degenerate and lose their vitality, the recuperative powers being too feeble to carry on the work of repair. Once begun, the disintegrating action never stops, and hence its ravages are often most frightful, as, for example, in the adjoining cut (fig. 44), where the disease successively involved skin, muscle, bone, cartilage, and fibrous membrane, sparing nothing that fell in its way. The pain attending the disease is of a sharp, darting, or pricking nature, and often extends through the surrounding parts. Hemorrhage occasionally occurs, chiefly in the fungating form of epithelial ulcer, and may be sufficiently copious to cause serious debility. Cases have been observed where the disease laid open large-sized arteries and veins.

During the progress of the disease, lymphatic involvement occurs;

sometimes early, but generally not until after the lapse of eight, twelve, or fifteen months. Thus, in epithelioma of the lip the ganglions of the jaw become enlarged, and in that of the penis the ganglions of the groin. The constitution also suffers severely, but usually not so early as in ordinary carcinoma, though ultimately not less fatally.

If a section be made of an epithelial cancer it will be found to grate under the knife, and to exhibit a firm whitish or grayish mass, more or less vascular, and of a radiating structure. In the lip and penis, it generally also contains well-marked papillæ, of varying size and shape, some being single, others united, which, however, are altogether adventitious, or they occur only in epithelioma of the mucous or mucocutaneous surfaces. Minutely examined, the morbid growth is observed to consist mainly of cells not unlike those of pavement epithelium, only that they are larger. The cells vary considerably in their shape, some being rounded, some oval, and some fusiform, angular, or elongated. The older ones are sometimes flattened, shrivelled, or curled up, as if, partially deprived of vitality, they were about to become effete. They usually contain one or two small nuclei, and either lie in superimposed layers, united by fibrous matter, or they are inclosed in peculiar cysts, which are almost characteristic of this class of morbid products. These appearances are well seen in fig. 45, from a drawing by Dr. Da Costa. Sometimes these cells and nuclei are unusually large and distinct, strongly resembling such as occur in true carcinoma. Mixed up with the cells of epithelioma, especially if the

Fig. 45.

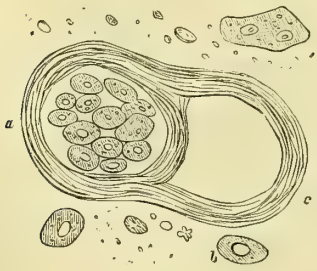


Fig. 46.



Fig. 45.—*a*. Cyst inclosing small cells; *b*. Large, rather round cells; *c*. Empty cyst. (From a drawing by Dr. Da Costa.)

Fig. 46.—*a*. Papilla taken from an epithelial cancer, magnified 250 diameters; *b*. Separate epithelial cells. (After Da Costa.)

disease has made some progress, are great numbers of free nuclei, and granules, and sometimes, also, of crystals of cholesterine, pigment cells, and blood corpuscles. The papillæ, previously alluded to, consist of loose fibrous tissue and bloodvessels very densely coated with layers of epithelial cells and free nuclei. Fig. 46 represents one taken from a cancroid affection of the lip. It will thus be perceived that the disease is deficient in some of the elements of ordinary cancer; a circumstance which accounts for its more manageable character.

Epithelial cancer is generally comparatively tardy in its growth. In a case of cancer of the tongue, reported by Dr. Da Costa, in the Phila-

delphia Medical Examiner for April, 1852, twenty-two years elapsed from the appearance of the disease to the time of the operation for its removal. Cancer of the lip often lasts a number of years before it terminates fatally, though this is not its ordinary tendency, most persons dying in from eighteen months to two years. I have seen cases of lupus of the face continue their ravages for nine, fifteen, and twenty years before the disease finally caused death. Under such circumstances, the ulceration occasionally for a time suspends its action, and then resumes it, perhaps now with increased vigor.

4. COLLOID.

Since the attention of pathologists has been more closely directed to this affection, it has been found to be a good deal more frequent than was formerly imagined; nevertheless, compared with some of the other heterologous formations, it is sufficiently rare. The name by which it is usually known has reference to the peculiar jelly-like appearance of one of its principal constituents, and is therefore quite appropriate. It has also been described under the terms gelatiniform, alveolar, and gum cancer.

The favorite seats of this morbid product are the omentum, stomach, rectum, ovary, lower jaw, subcutaneous cellular tissue, and the bones of the extremities. The testicle, mamma, uterus, and lymphatic ganglions are also occasionally attacked by it. It has never been seen in the eye and its appendages.

It may occur simultaneously in a considerable number of organs, but manifests less tendency to general diffusion than any of the other heterologous formations, except the epithelial. It takes place in both sexes, and at all periods of life after puberty, but is most common between thirty-five and fifty. In two instances of enormous colloid tumors of the omentum, observed by myself, the patients were respectively forty and forty-nine. In a case which I noticed in the body of the sphenoid bone, beneath the dura mater, the age was thirty-nine.

Colloid occurs under two *varieties of form*, as a tumor, and as an infiltration. The latter is most common in the alimentary canal, particularly the stomach and rectum; the former, in the glandular organs, the peritoneum and omentum, ovary, cellular tissue, and the bones. In the bones it is most frequent in those affections known under the vague names of osteo-sarcoma and spina ventosa, which are sometimes, in great measure, composed of this substance. In the infiltrated variety of colloid, the new matter occupies the meshes of the cellular substance, forming cysts, from the size of a mustard-seed to that of a hazel-nut, which are filled with the characteristic jelly-like matter, and which, as they increase in volume and number, so completely subvert the primitive structures as ultimately to leave no trace of them.

In the other variety of colloid, the heteroclite matter occurs in the form of a distinct tumor, from the volume of a marble to that of an adult head, of a globular, rounded, or irregular shape, and of a firm, dense consistence. In the peritoneal cavity, I have seen, on two occasions, enormous tumors of this kind, one of which was supposed,

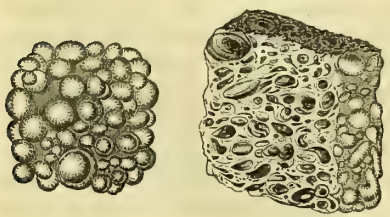
by estimate, to weigh not less than twenty-five pounds. It extended from the pelvis to the diaphragm, surrounded the colon and part of the stomach, and almost completely concealed the abdominal viscera; its length being nearly one foot, its breadth upwards of eight inches, and its thickness from two and a half to three inches. The patient, aged forty-nine, had been laboring under the disease for four years. In the other case, that of a gentleman of forty, the tumor occupied the same situation, and was also of extraordinary extent. When the disease was first noticed, eight months before he died, the morbid mass was already of large size, forming an immense protuberance, which bore upon the walls of the abdomen in every direction, without causing the slightest inconvenience, save what resulted from its bulk.

The surface of the colloid tumor is generally rough, knobby, or distinctly lobulated, according to the volume and arrangement of the component cysts. Occasionally it bears a strong resemblance to the exterior of a pudding stone. The knife, as it passes through it, makes a creaking noise; it contains very little cellular substance, and the investing cyst is usually very thin. In the larger masses, considerable sized vessels may be seen running over the surface, and penetrating the walls of the principal cysts, without, however, passing through their contents.

Colloid consists of two component elements, a stroma, and the peculiar jelly-like matter, from which the deposit derives its distinctive features. The former is of a fibrous character, and is arranged in such a manner as to form cells, loculi, or cavities, from the size of a pin head up to that of a small marble, rounded, ovoidal, or angular; communicating with each other, and lined by a thin, delicate, transparent membrane, which, excepting that it is not a shut sac, closely resembles the serous tissue. The stroma is of new formation, and generally possesses great firmness and density; it creaks under the knife, and is of a dull whitish, grayish, or pale yellowish color. The cystiform structure of colloid is easily recognized in all specimens of the disease, and is so remarkable that, once seen, it can never be forgotten. It is well illustrated in the annexed cuts; fig. 47 showing the external arrangement, and fig. 48 the internal.

The fibrous matter of colloid is almost destitute of free cellular substance. It receives, however, an abundant supply of vessels, as I have satisfied myself by dissection, and as is evinced also by the rapid development of the morbid growth, and the great bulk which it occasionally attains. In one case in particular I had no difficulty in tracing several large, straggling arteries into a tumor of this kind, showing that it had a very active circulation. The manner, however, in which the vascular system of the morbid product is arranged is not determined; nor is it ascer-

Fig. 47. Fig 48.



Colloid tumor. Fig. 47, external appearance. Fig. 48, internal structure. From a preparation in the author's collection.

tained whether it is of new formation, or derived solely from the surrounding and included healthy structures. Of the character of its nerves and absorbents, we are equally uninformed.

The other element of colloid is an unorganizable product, of a whitish, greenish, or yellowish color, and of the consistence of ordinary jelly, whence the name by which the disease is usually known. In the older cells the matter is sometimes as firm as moist cheese, or the white of a hard-boiled egg, opaque, and of a white pearly or yellowish hue, interspersed with minute dark points. Sometimes, again, it resembles currant jelly, half dissolved glue, or a solution of gum shellac. However this may be, it never adheres to the walls of the cells, and is, therefore, easily enucleated, or pressed out. When perfect clearance has been effected of the cells of a mass of colloid, the fibrous structure exhibits very much the appearance of a piece of sponge, the alveolar arrangement being then particularly conspicuous, hundreds of cells being often visible upon a surface less than an inch in diameter.

Although the soft matter of colloid looks so much like jelly, yet chemical analysis has shown that it is entirely destitute of this substance, its principal constituents being albumen, casein, and osmazome, in varying proportions. Destructive analysis has yielded, in the 100 parts, 48.09 of carbon, 7.47 of hydrogen, 37.44 of oxygen, and 7.00 of nitrogen.

Under the microscope colloid appears as a homogeneous substance, with now and then a slightly granular arrangement, or large irregular plates. In this basis-structure are seen nucleated corpuscles, and large parent cells, inclosing several smaller ones. Cancer-cells, such as occur in scirrhus and encephaloid, are occasionally found in it, but not as a necessary constituent, since in some specimens they are entirely absent. Moreover, it is worthy of notice that corpuscles, very similar to those of colloid, sometimes occur in gelatinoid infiltrations of the spleen, heart, and thymus. The stroma of colloid is essentially composed of fibrin.

It is impossible, in the existing state of our knowledge, to determine the precise nature of colloid, or to assign to it its proper position in the scale of the heterologous formations. It is certainly destitute of many of the properties of carcinomatous disease, and yet its career, so far as I have had occasion to watch it in my own practice, is not the less positively fatal, especially when it occurs in the internal organs. In the osseous structures, it may occasionally be removed without relapse, and the same thing may probably be true in regard to colloid in some other situations; but upon this subject we are in need of further light. It has less disposition to ulcerate, and to contaminate the surrounding lymphatic ganglions, than the other heterologous formations.

5. MELANOSIS.

Melanosis, sometimes called black cancer, occurs most commonly in the cellulo-adipose tissue beneath the skin, in the folds of the mesen-

tery and omentum, around the kidneys, in the mediastinal cavities, the lymphatic ganglions, the eye, liver, lungs, and parotid glands. It is also met with, though more rarely, in the serous and fibrous membranes, the bones, ovaries, heart, pancreas, and spleen. Occurring usually alone, it occasionally coexists with some of the other heterologous deposits, especially the scirrhous and encephaloid, and may attack quite a considerable number of organs either simultaneously or successively. It takes place in both sexes, and at all periods of life, but is most frequent in adults and middle-aged subjects.

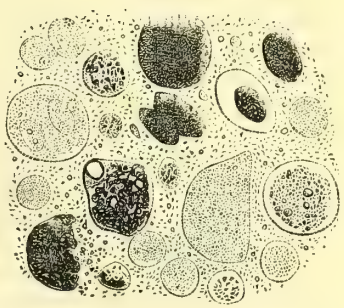
An instance in which the melanotic diathesis prevailed to a remarkable extent came under my observation in 1855, in a man, aged fifty-eight years, who, after a confinement of nearly twelve months, finally died in a state of extreme exhaustion, the prominent symptoms having been harassing cough, occasional discharges of blood from the bowels, irritability of the bladder, frequency of the pulse, and copious night-sweats. Melanotic tubercles existed in the subcutaneous cellular tissue in various regions, the lymphatic ganglions of the groin, axilla, and bronchia, the omentum and peritoneum, stomach, large and small bowels, pancreas, liver and gall-bladder, kidneys and supra-renal capsules, urinary bladder, prostate gland, seminal vesicles, lungs and pleura, heart, and thyroid body. The spleen and large vessels were sound. The brain, bones, and muscles were not examined. A notable feature in the case was the existence of numerous white and grayish tubercles in the midst of the black, showing that the former were in a nascent condition, having not yet undergone the melanotic transformation.

The melanotic matter is deposited in several *varieties of form*, of which the tuberoid is the most common. It occurs in small masses, of a rounded, ovoidal, or irregular shape, with or without a cyst, and from the size of a pin-head to that of a walnut. Of a dull sooty, brownish, or black color, they are generally invested by a distinct capsule, formed out of the cellular tissue in their immediate vicinity, which thus serves to separate and protect them. Fibrous bands generally intersect their interior, and vessels are often seen ramifying over their surface, none of them, however, dipping into the proper melanotic matter. It is by the union of several of these smaller masses that large tumors are sometimes formed, reaching now and then the volume of a fist and even of a fœtal head. Cases occur in which this matter presents itself in small points, or in irregular patches, generally beneath some serous membrane. Finally, it is sometimes found in a liquid form.

Melanotic matter, in a pure state, is of a sooty black, dark brown, or dull bistre color, its consistence varying from the fluidity of ink to that of fibro-cartilage. Its chemical constituents are albumen, fibrin, and a dark, highly carbonized substance, not unlike the cruor of the blood, with a minute quantity of iron, soda, magnesia, lime, and potash. It is opaque, without odor or taste, and miscible with water and alcohol; it imparts a characteristic stain to linen, resists decomposition, and emits an empyreumatic smell when burned.

Examined microscopically, melanotic matter is found to consist of a fibrous network, inclosing numerous meshes, which are filled with free, unadherent pigment cells, of a pale yellowish, dark, or dark brown hue, and of a rounded, oval, or irregular figure; they are of great delicacy, and are occupied by colored granules, a few of the larger or older ones sometimes containing a nucleus with its nucleolus. These appearances are well represented in the adjoining cut (fig. 49). Pigment cells are not present in all cases, and their granules are occasionally seen in other structures, both healthy and morbid, as in the lung pigment and in the elements of carcinomatous growths.

Fig. 49.



Microscopic structure of a melanotic tumor.

The precise nature of melanosis is undetermined. I am, however, inclined to believe that it is merely a modification of encephaloid, the chief difference consisting in the superaddition of black pigment. What corroborates this view is the fact that tumors, partaking of the character of both these formations, occasionally co-exist, either in the same, or in different parts of the body; and the circumstance, also, that they exhibit similar histological elements.

Of the causes of this deposit nothing is known. It is always effused in a liquid form, and is wholly unorganizable, receiving neither vessels nor nerves; though these are freely distributed through its fibrous stroma. It has been supposed that black cancer might be communicated by inoculation, or immediate contact, but experiments upon the inferior animals have refuted this conjecture.

After having remained stationary for an indefinite period, this matter manifests a disposition to disintegration, the softening process generally beginning at some superficial point, and thence gradually extending to the skin, which, giving way, leads to the establishment of a foul, non-granulating, unhealthy ulcer, which no skill can cure. The discharge is generally of a sanious character, mixed with and discolored by the heteroclite secretion. Its progress is usually more tardy than that of scirrhus and encephaloid, except when it exists simultaneously in a great number of organs, as in the case above described, where it terminated fatally in a little over a year. The general health often suffers long before ulcerative action sets in, the patient becoming thin, haggard and sallow.

Having thus described each malignant tumor separately, I shall, in the next place, offer some remarks on the origin of this class of affections, their diagnosis, and treatment.

Local Origin.—It has been supposed that all malignant diseases are occasionally of a purely local character, having their origin in causes en-

tirely independent of the general system; or, what amounts to the same thing, that they may be developed under the influence of local injury. But such an opinion, it seems to me, is hardly tenable; at all events, it admits of great doubt whether such a result really ever follows such a cause; it certainly could not, one would suppose, unless there is a predisposition, a readiness, as it were, on the part of the system, to generate cancer cells, or to take on malignant action; else why is it that external violence, as a blow or bruise, so seldom gives rise to this horrible and unmanageable complaint? Why, in other words, is it that a blow will produce cancer in one person and not in another; or, still farther, why will one individual suffer and a thousand escape?

Cancer of the lip has often been attributed to the irritation produced by the hot and filthy stem of the earthen pipe in smoking. But it may well be asked whether the use of the pipe and the occurrence of this frightful disease should not be viewed rather in the light of a coincidence than in that of cause and effect? Be this as it may, it is unquestionable that thousands of persons smoke and yet never suffer from cancer of the lip. So in regard to many of the other circumstances alleged to be capable of inducing malignant disease, as grief, mental anxiety, loss of rest, unwholesome food, and disorder of the menstrual function, which are so often accused of provoking carcinoma in the mamma and uterus. Unless, therefore, a predisposition exists in the system to the development of these affections, it admits, I think, of great doubt whether it is possible for any local irritation to originate them. It is far more probable that they take their rise in the blood, but how, or in what particular element of this fluid, we are of course totally ignorant. It has been asserted that cancer cells have been detected in the blood, but if this has been the fact it is certain that they were not formed there, but that they were simply introduced through the agency of the vessels during the progress of carcinomatous disease. To arrive at any other conclusion would be absurd.

Can a tumor of an innocent, benign, or non-cancerous character, in its progress, become malignant? in other words, is such a growth capable of what has been termed the carcinomatous degeneration? It seems to me that it is not difficult to give a correct answer to this question. If the term "degeneration" is restricted to its true and legitimate signification, then we must reply in the negative, for no tumor, whatever be its structure, can, by a mere conversion or transformation, pass into a malignant condition. Such a change can be effected only under the influence of a vital process, involving the development and actual existence of the cancer-cell; and I cannot, for my own part, see any good reason why a new growth, tumor, or deposit should be more exempt from such a disease than a primitive, original, or pre-existing tissue, whatever be its structure. Nay, indeed, may it not be supposed that the more feebly a part is organized, the more prone will it be to take on such a process? That this change does sometimes occur, may be inferred from the circumstance that tumors, believed to be cancerous, but which cannot be positively proved to be of this description, remain, occasionally, in a state of latency for ten, fifteen, twenty, and even thirty years, and then, all of a sudden, manifest a

malignant and destructive action, generally followed by the worst consequences.

It would be of great practical utility if we knew the origin of cancer, or if we were acquainted with the causes, local and constitutional, under the influence of which malignant diseases, properly so called, are developed. But upon this subject, unfortunately, we are entirely ignorant, nor is it likely that our inquiries concerning it will lead to a satisfactory solution of a question which has occupied so much attention.

Carcinoma is sometimes *hereditary;* not, however, so frequently as is generally supposed. Besides, it should be remembered that there is a difference, and that a very wide one, between the transmissibility of this disease from the parent to the offspring, and its coexistence, or successive development, in different members of the same family. The latter occurrence, although also very infrequent, is much more common than the former, of which my own experience has supplied me with only a few examples. Lately, I saw a lady with a well-marked cancer of the mammary gland, whose mother and maternal aunt had died of the same disease. In the summer of 1850, I prescribed for an aged female with a cancer of the lip, whose mother had perished from cancer of the breast, and the father from cancer of the tongue. But the most remarkable and instructive instance of this kind, probably, upon record, is that related by Dr. Warren, in his work on Tumors. A man died of cancer of the lip; his son had a similar disease in the breast, from which, after having undergone an operation at the age of sixty, he finally lost his life. Two of his sisters had cancer of the mammary gland; they were operated upon, but ultimately died from a relapse of the malady. A daughter of one of the ladies had a cancer of the breast, which was removed at an early period; she recovered, but perished some years after from disease of the uterus. A daughter of the gentleman had a cancer of the breast, and there was reason to believe that other members of the family were affected by the same malady.

A case, almost equally remarkable, of this hereditary tendency to cancer, has been communicated to me by Dr. J. M. Warren. In this instance, a man who died of cancer of the penis, lost his father, grandfather, and great-grandfather from the same disease.

More frequently, as has been already stated, the disease occurs, either simultaneously or successively, in several members of the same family. My own practice has afforded me a number of instances of the kind, and there is not a writer on carcinoma that does not narrate examples of it. In one remarkable case, four out of six members of one family have died of the disease; one from cancer of the uterus; another from cancer of the mammary gland; a third from a malignant polyp of the nose; and the fourth from carcinoma of the thoracic viscera. Professor Gibson gives an instance of cancer of the breast in four sisters.

Diagnosis.—Epithelial cancer is usually sufficiently easy of recognition. Its situation at the junction of the skin and mucous membranes, or upon either of these structures; its origin in a crack, fissure, or

wart-like excrescence; its extraordinary firmness, the part feeling like a mass of fibro-cartilage; its slow growth; its small size; and the absence, for a long time, of severe pain and constitutional taint; are features that cannot be mistaken.

The only characteristic sign of melanosis is the peculiarity of the color of the tumor; hence, when it is situated superficially, as when it occupies the skin, eye, parotid gland, or lymphatic ganglions, it is quite impossible to mistake the nature of the disease.

Colloid tumors are liable to be confounded with fibrous and enchondromatous formations; but a careful consideration of the history of the case, and a thorough examination of the morbid mass will generally serve to clear up any doubt that may arise in regard to the diagnosis. Colloid growths are usually situated in the peritoneal cavity, in the ovary, or in the bones; they are slow in their progress, smooth or rough on the surface, of uniform consistence throughout, and free from pain, their bulk being usually enormous, and the general health greatly disordered. Fibrous tumors advance slowly, seldom attain a great bulk, and do not usually seriously undermine the constitution. The enchondromatous growth is harder and less elastic than the colloid; its progress is rather rapid, and its outlines are always well defined, which is seldom the case with alveolar cancer.

Almost the only disease with which encephaloid is liable to be confounded is scirrhus, and it will therefore be necessary to point out their differential diagnosis. For this purpose I give the subjoined table of the characteristics of the two affections.

ENCEPHALOID.	SCIRRHUS.
1. The tumor is soft and elastic, not uniformly, but more so at some points than at others.	1. Uniformly hard and inelastic, feeling like a marble beneath the skin.
2. It grows rapidly and soon acquires a large bulk, perhaps ultimately attaining the volume of an adult's head.	2. Growth is slow, and bulk comparatively small; the tumor rarely, even in the worst cases, exceeding the volume of a double fist.
3. The pain is slight, and erratic, until ulceration begins, when it becomes more severe and fixed.	3. The pain begins early, is distinctly localized, and is of a sharp, darting, burning, or lancinating character.
4. There is always marked enlargement of the subcutaneous veins.	4. In scirrhus these vessels retain their natural size, or are only slightly enlarged.
5. The ulcer is foul and fungous, with thin, undermined, and livid edges, and is subject to frequent and copious hemorrhage.	5. The ulcer is incrusted with spoiled lymph, and has steep, abrupt edges, looking as if it had been punched in the part; bleeding little, and seldom.
6. There is generally early lymphatic involvement.	6. Usually not until late, or just before ulceration is about to occur.
7. Occurs at all periods of life.	7. Seldom before the age of forty-five.
8. Is most frequent in the eye, testicle, mamma, lymphatic ganglions, bones, and cellular tissue.	8. Never occurs in the eye and testicle, and seldom in the bones and lymphatic ganglions.
9. The disease usually terminates fatally in from nine to twelve months.	9. Seldom sooner than eighteen months or two years.

It is not improbable that an encephaloid tumor might be confounded with a chronic abscess, or an aneurism, especially when it is so situated as to receive an impulse from a neighboring artery. The very mention

of the possibility of such an occurrence will be sufficient to put the young and inexperienced practitioner upon his guard, and serve to point out to him the absolute necessity of the most profound caution in every case of a suspicious character.

It has been proposed, in cases of doubt, to solve the difficulty by means of the exploring needle, or, rather, of an instrument so constructed as to admit of the removal of a portion of the morbid growth just sufficient to answer the purposes of a microscopic examination. I must confess, however, that I have a great aversion to all such procedures, believing that they generally prove prejudicial to the part, by provoking an increase of the morbid deposit, the puncture serving as a new centre of action. I have witnessed in at least two instances great harm from the operation, and have therefore of late years uniformly discountenanced it.

Besides, it is questionable, even supposing that such an exploration could be made with perfect safety, whether it could eventuate in much benefit. The microscope is certainly not infallible. It is often a valuable auxiliary, but nothing more. The practical surgeon must indeed be dull who cannot, as a general rule, determine the character of a morbid growth before he attempts its removal. The merest tyro in the profession has no difficulty in discriminating between a gelatinoid and a fibrous polyp of the nose, a scirrhous and an encephaloid tumor of the breast, or a common hypertrophied ganglion of the neck and a malignant growth of the same part. Every new growth, whether benign or malignant, has its peculiar features, not less than every pre-existing one. I believe that, with proper care, and a reasonable knowledge of morbid structure, such as every cultivated surgeon ought to possess, it is, in general, as easy to determine the difference between a malignant and a non-malignant tumor as it is to determine the difference between a muscle and a tendon. In making these remarks I have no desire to underrate microscopical researches; on the contrary, I only wish to state that they have not, in my judgment, effected all the good that has been claimed for them, especially in this particular department of pathology and practice, and that, therefore, their results should be received with some degree of allowance. In fact, the whole subject of morbid growths, benign and malignant, should be revised and re-examined. When there is so much dispute as there confessedly is at present respecting the real nature of the cancer-cell, or, whether indeed there is such a cell at all, it well becomes the practitioner to look with distrust upon many of the alleged discoveries of the microscope. Besides, he should not lose sight of the value of his unassisted senses, nor cease to cultivate them in the highest possible degree.

After a malignant disease, whatever may be its character, has made considerable progress, so as to impress itself upon the constitution, the diagnosis, however obscure it may have been in the early stages of the affection, is no longer doubtful. The worn and haggard features, the sallow complexion, and the emaciated and exsanguine condition of the system, are characters which it is impossible to mistake. The countenance bears the impress of the disease, looking as if it had been stamped with the seal of malignancy.

TREATMENT.

The treatment of the various forms of malignant growths may very properly be discussed under one general head, since they are evidently all governed by the same laws, both as it respects their origin, progress, tendency, and termination. All internal remedies, of whatever kind and character, have proved unavailing in arresting their march, or in modifying them in such a manner as to render the surrounding structures tolerant of their presence. The vaunted specific of the empiric, and the enchanted draught of the honest but misguided enthusiast, have alike failed in performing a solitary cure; and the science of the nineteenth century must confess, with shame and confusion, its utter inability to offer even any rational suggestions for the relief of this class of affections. But, although this is the case, yet it by no means follows that the subjects of these complaints may not be benefited by general and local treatment, if its application be directed by common sense and sound judgment. Every practitioner of experience knows how much ordinary local diseases are influenced by constitutional measures; and if this be true of these lesions, how much more must it be true of the malignant, in the production of which both the solids and fluids play such an important part. The attention of the surgeon should be particularly directed to the patient's diet, bowels, and secretions, and to the avoidance of all sources of local irritation, calculated to favor the morbid growth, and hasten the fatal issue.

The *diet* should, in general, be of a bland and unirritant character, but at the same time sufficiently nutritious to preserve a sound condition of the blood, and maintain the tone of the muscular system. All condiments, coffee, strong tea, pastry, hot bread, and the coarser kinds of vegetables and meats should be abstained from. Eggs, fish, oysters, and the white kinds of meat may be used once a day in moderate quantity, but oftener than this they should not be indulged in, unless there is some special reason for it, founded upon the state of the general health. Frequently a purely farinaceous and milk diet is found to answer better than any other, the patient not only thriving under it, but the disease being apparently kept in check by it.

The *bowels* should be maintained in a soluble condition, but all active purgation must be carefully avoided. The most suitable aperient, when a tendency to constipation exists, is a blue pill, with one grain of ipecacuanha, or equal parts of blue mass and jalap, at bedtime, followed, if necessary, by a Seidlitz powder in the morning. If evidence of gastro-intestinal irritation arise, the blue mass may be advantageously replaced by a small portion of calomel. In this way, while the bowels are maintained in a tolerably free state, the secretions are also duly preserved; a matter of no little moment in the treatment of all malignant diseases without exception, especially when they are attended with marked constitutional disturbance.

Sleep is procured and pain allayed by anodynes, the constipating effects of which are counteracted by the conjoined use of ipecacuanha or tartar emetic, in suitable doses. When the suffering is of a neural-

gic character, the anodynes may be combined with arsenic or arsenic and strychnine.

If marked *debility* exists, recourse must be had to tonics, as quinine and iron, aided by a nutritious diet and the use of brandy, wine, ale, or porter. Night-sweats are best controlled by aromatic sulphuric acid.

Great care should be taken to keep the affected part perfectly at *rest*, and free from pressure and excitement. If it be the breast or testicle that is diseased, the organ must be well suspended, the dress worn loose, and all manipulation studiously abstained from. If the surface is tender, hot, and swollen, or œdematous, some mildly astringent and anodyne lotion will be of service, or the part may be painted several times a day with a weak solution of iodine. When the local inflammation is unusually severe, as is evinced by the discoloration and pain, nothing, according to my observation, will afford such prompt and decided relief as the application of from four to six leeches, unless it be a small blister, kept on until there is pretty free vesication. Some cases are greatly benefited by the use of an opium, belladonna, or cicuta plaster, renewed every ten or twelve days. All caustic applications are to be carefully avoided, inasmuch as they can never do any good, but may do a great deal of harm by establishing sores which it will afterwards be impossible to heal.

When the parts take on *ulcerative* action, the resulting sore must be kept constantly clean by frequent ablutions; while the excessive fetor which so generally attends must be allayed by the free use of the chlorides. The best dressing will be an emollient poultice, particularly that made of powdered elm bark, sprinkled, if there be much pain, with a little morphia, powdered opium, or laudanum. If the ulcer be very sensitive, it should occasionally be touched, very lightly, with the solid nitrate of silver, or it should be kept constantly covered with the dilute ointment of the nitrate of mercury. When the discharge is very profuse, sanious, and offensive, a lotion composed of from two to four drops of nitric acid to the ounce of mucilage of gum arabic will be found exceedingly beneficial in diminishing its quantity and changing its character.

The affected glands in the neighborhood of the diseased organ often require attention, especially when they are very painful and bulky. The remedies should be of an anodyne and antiphlogistic character, especially leeches, iodine, and saturnine lotions.

The treatment of carcinomatous diseases *by compression* was introduced to the notice of the profession early in the present century by Sir Charles Bell, and, after having been alternately eulogized and condemned, has at length fallen into merited disrepute. Some years ago Mr. Arnott, of London, made an attempt to revive this mode of treatment, especially in cancer of the mammary gland, by the invention of a cup-shaped apparatus furnished with an elastic air-cushion, in order to apply the pressure in a more gentle and equable manner. The suggestion, emanating from so eminent an authority, attracted much attention at the time, and led to numerous trials, both in Europe and in this country, but with results so discouraging as to have caused its entire abandonment.

In regard to *extirpation*, all experience has proved that it cannot be relied upon as a means of permanent cure. The only benefit which it can confer is temporary relief for a few months, or, at most, for a year or two; and this is true no matter in how masterly and thorough a manner the operation may be executed. Hence not a few surgeons of the present day have expressed themselves as altogether averse to such a procedure, believing that it will only serve, in the great majority of instances, to hurry on the case to a fatal crisis. My own conviction is that interference with the knife is, as a general rule, only productive of harm, and that the patient will live quite as long without as with it, and, on the whole, in a state of greater comfort. Nevertheless, there are cases, although it is difficult to define their character, where we occasionally see an operation followed by highly beneficial results, not only ameliorating pain, but apparently preventing an extension of the disease, and relieving the mind of that terrible feeling of anxiety which is so sure to attend the more severe forms of carcinoma. The cases which have done best in my own hands, after operation, were females with scirrhous breasts, which, after having been long in a quiescent state, at length assumed a threatening ulcerative tendency, or which had actually, in a slight degree, yielded to this process.

Epithelial cancer is less liable to recur after extirpation than scirrhus, encephaloid, or melanosis. Removed in its earlier stages, there is occasionally a strong probability that there will be either no relapse at all, or only after a considerable period. One reason probably of this is the fact that the disease is more of a local character than the ordinary forms of carcinoma.

General Rules for conducting Excision of Malignant Diseases.—When excision is determined upon, it is a matter of paramount importance that it should be performed in the most thorough and complete manner, in order that the parts may be effectually guarded against relapse. The slightest atom of the new tissue, the most minute cancer-cell, nay, possibly, the smallest particle of cancer-juice, may, if left behind, endanger a reproduction of the malady.

1st. To accomplish this object, it is necessary that the incisions should be carried through the healthy tissues at some distance from the morbid deposit. Should any part have escaped the knife in the first instance, it should be traced out immediately after the extirpation of the main mass, and be excised with the most scrupulous exactness. Free use should be made, in this stage of the operation, of the sponge and finger; of the former, for clearing away the blood, and of the latter, for ascertaining the consistence of the surface of the wound. The sight alone should never be trusted in a case of this kind, inasmuch as it is a great deal more deceptive than the sense of touch. Not a particle of the least suspicious substance should be left behind. Skin, muscle, glands, vessels, nerves, and bone should all be sacrificed, if necessary to the success of the operation. Nay, the very atmosphere of the disease should be destroyed; and, with this view, the surgeon should always remove a considerable amount of healthy substance.

2dly. The operator should endeavor to preserve as much of the common integument as possible, in order to afford a complete cover-

ing to the surface of the wound. This rule is one of great importance, and should never be departed from. Another precept, of nearly equal consequence, but one which is not generally sufficiently insisted upon, is to preserve as large a quantity as practicable of the subcutaneous cellulo-adipose tissue, with a view of maintaining, unimpaired, the circulation of the skin. Whenever this is much interrupted, as it necessarily must be by a very close dissection, there is additional danger of a speedy return of the abnormal action, and also greater risk of erysipelas immediately after the operation.

3dly. When only a portion of an organ is involved by the heteromorphous matter, the rule is to remove, not a part, but the whole of it. Thus, in cancer of the mammary gland, the practice invariably is to extirpate the entire organ, no matter how small a portion may be implicated in the disease. Upon this point, surgeons have long been agreed. When the disease is seated in an extremity, especially the distal portion, the proper operation is amputation, not excision.

4thly. In removing a malignant tumor we should always endeavor to avoid loss of blood. This is a good rule, even when the patient is tolerably plethoric; but its observance is especially important in lean and fat subjects, the latter of whom, in particular, generally bear the loss of this fluid very badly. I deem it a matter of great moment to guard against hemorrhage in every operation of this kind, not so much on account of the immediate recovery of the patient, as on account of the danger of relapse, which, I confidently believe, is frequently very much increased by this accident.

5thly. It is a matter of great consequence, in reference to the question of relapse, that the whole of the wound left by the operation should be healed by the first intention. For this purpose, the parts should always be approximated as nicely as possible, not only at their edges, but also over the surface of the wound, that there may be no cavities or pouches for the lodgement of matter, but that the restorative process may proceed in the best and most rapid manner at every point. The most suitable dressings are a light compress and bandage, aided by adhesive strips or collodion plaster. Sutures are objectionable, because the track made by them occasionally serves as a point of departure for new deposits, thereby promoting relapse. They cannot, however, always be dispensed with, especially when there is a scarcity of integument.

6thly. When the integument is defective, it is sometimes practicable to borrow the requisite amount from the surrounding parts; an operation first suggested, I believe, by Martinet, who imagined that we could thereby generally, if not always, effectually prevent a return of the disease. He thought we might thus change the functions of the parts in such a manner as to restore their healthy nutrition, and so counteract the tendency to the production of cancer.

I have had recourse to this procedure in a number of instances, in different regions of the body, especially in epithelial cancer of the lips and eyelids; but in none with any permanent or even protracted benefit. For a time the transplanted parts retained their healthy character; but at the end of a few months they gradually became hard

and rigid, and soon thereafter exhibited all the evidences of carcinomatous disease.

7thly. When a sufficiency of integument cannot be obtained, and the wound is obliged to heal by the granulating process, it is worthy of consideration whether the whole of the raw surface should not be effectually cauterized with the nitrate of silver, or the acid nitrate of mercury, so as to form a superficial eschar. The practice certainly derives support from the beneficial effects which are said to follow the treatment of cancer by cauterization in the hands of the empirics, as well as in the hands of some scientific practitioners.

Finally, considerable diversity of opinion has existed among surgeons as to the time when the operation should be undertaken with the best prospect of ultimate success. The preponderance of professional sentiment, however, has always been in favor of early interference, on the ground that the longer the disease is permitted to remain, the greater, all other things being equal, will be the risk of contamination. The advocates of this measure, indeed, never countenance a resort to the knife when there is positive evidence that the disease has invaded the adjacent parts, or the system at large. Some, it is true, employ it with a view of prolonging life, or alleviating suffering, but never with the hope of effecting a radical cure.

Treatment after Operation. — The treatment after removal of the affected structure must be conducted upon general principles. Everything should be done calculated to insure union by the first intention. When the patient has recovered from the immediate effects of the operation, he should be put upon a general course of treatment intended to maintain his health as near as possible at the normal standard. Above all, strict and constant attention should be bestowed upon the diet.

Of the propriety and importance of attention to the patient's diet, after excision, no one can entertain any doubt. The force of this remark will appear the more evident when it is recollected that the progress of cancer has occasionally been stayed for months, and even years, by a regular and persistent system of starvation, barely allowing a sufficient quantity of food, and that of the most bland and unirritant character, to maintain the due play of the vital functions, without too great a reduction of the heart's action.

The kind of diet is, doubtless, a matter of no little moment. As a general rule, it may be stated that meats, soups, and the coarser varieties of vegetables should be proscribed, on account of their heating and indigestible character. For the same reason, condiments, wine, spirits, and fermented liquors are to be eschewed. Among the more suitable articles may be mentioned stale bread, toast, and soda biscuit, hominy, rice, sweet and Irish potatoes, mush, maccaroni, baked apples, figs, and ripe fruits. Not only should the food be perfectly simple and easy of digestion, but great care should be taken that it is always thoroughly masticated, and that the quantity at each meal is never so great as to crowd and oppress the stomach. As drinks, the best articles are water, milk, and weak tea. Coffee is too stimulating, and must be avoided.

Of late years almost an exclusive milk diet has been used in several remarkable cases after this operation, and with effects so encouraging as to deserve farther trial. The facts published upon this subject by Dr. Pierce, Dr. Bowditch, and several others, are exceedingly interesting and instructive, and should receive attentive consideration.

As there are no remedies which will eradicate the cancerous poison from the system before operation, so are there none which will prevent its reproduction after. Of the numerous articles that have been employed for this purpose there is not one that can be viewed in the light of a specific, or as a counteragent to the morbid action.

Some of the older surgeons, and, indeed, quite a number also of the modern, strongly insist upon the establishment of a kind of perpetual drain in the neighborhood of the original disease, as a means of preventing relapse after extirpation. The principal measures that have been suggested for this purpose are the issue and seton; but with this mode of treatment I have no experience.

Should relapse ensue, and the patient become debilitated, recourse must be had to supporting measures, as quinine, iron, brandy, and nutritious food, aided by gentle exercise in the open air. Pain must be allayed by the free use of anodynes, and night sweats by elixir of vitriol, or oxide of zinc, given in as large doses as the stomach will tolerate. Constant attention must be paid to cleanliness; fetor must be destroyed by the chlorides; and the utmost care must be taken to protect the parts from the pressure of the clothes and rude contact of every description. The most suitable local remedies are leeches, the dilute tincture of iodine, emollient cataplasms, medicated with anodynes, and opiate plasters.

Contra-indications to Surgical Interference.—The following circumstances may be enumerated as contra-indicating the removal of malignant tumors:—

1st. No operation should be performed when the disease is congenital, or when it manifests itself soon after birth. Under such circumstances, a resort to the knife is almost certain to be followed by relapse, and that, too, in a very short time, owing, probably, to the fact that the system is, as it were, saturated with the cancerous poison. Cases of this kind are peculiarly virulent and intractable, resisting all attempts at cure, frequently, indeed, even at palliation, and rapidly tending to a fatal termination. The occurrence of the disease in several members of the same family may also be regarded as contra-indicating ablation, inasmuch as it is denotive of a constitutional proclivity to malignant action.

2dly. Interference should be avoided when the disease exists in several parts of the body; as, for instance, when it affects the mamma and the uterus, or the testicle and the eye. Although all these organs are accessible to the knife, yet a resort to it under such circumstances would be highly injudicious, inasmuch as it could not possibly eventuate in any permanent good, but, on the contrary, be almost sure to hasten the patient's destruction. No surgeon, however reckless, would think of operating when the external disease is associated with carcinoma of an internal part.

3dly. Operation is never resorted to, at least not as a curative agent, when the morbid growth has attained unusual magnitude: when there is serious local involvement; or, lastly, when there is marked evidence of the carcinomatous cachexia. Thus, in cancer of the mamma, no surgeon who values his reputation, or who has any regard for the welfare of his patient, thinks of interfering when there is great bulk of the tumor, or firm adhesion of the organ to the surrounding parts; when the skin is changed in structure, ulcerated, indurated, or dimpled; when there is enlargement of the axillary, subclavicular, or sternal lymphatic ganglions; when there is œdema, with numbness and loss of function in the corresponding limb; and, finally, when, in addition to some of the symptoms just mentioned, the features exhibit all the evidences of the cancerous cachexy. The same circumstances guide the surgeon in carcinoma of the testicle, eye, lip, penis, and extremities. If the knife is ever employed when the malady has made such progress and such inroads, it is with a view solely to palliation, not to cure. Of the propriety of such a course, every surgeon must be his own judge.

4thly. When the disease advances very rapidly, as it not unfrequently does in encephaloid, breaking through its original boundaries, and leaping, as it were, suddenly into the surrounding tissues, it may be assumed, as a general rule, that ablation will be improper; or that, if had recourse to, a rapid repullulation will be the consequence. Rapid growth, constituting what has sometimes been denominated the acute form of malignant action, always implies a bad state of the constitution, and imperatively forbids surgical interference. There is another symptom which is equally portentous, but which has not, I think, engaged sufficient attention. I allude to the œdematous appearance of the parts immediately around the morbid deposit, or at a distance more or less remote from it. This condition, which is seldom absent in external carcinoma in its latter stages, is not unfrequently present at an early period in encephaloid, especially the hematoid variety of this affection, and always denotes the very worst state of things, both local and constitutional. The immediate cause of this symptom is obstruction of the lymphatic vessels and ganglions. Observation has taught me that nothing but mischief is to be expected from interference when the malady has attained this crisis.

5thly. A quickened state of the pulse, occasioned by the local irritation, augurs unfavorably. Excision, performed under such circumstances, is nearly always followed by speedy relapse; and it is, therefore, the duty of the surgeon to discountenance it.

6thly. Latent cancers should not be tampered with. Cases constantly occur in which, from neglect of this precaution, the patient loses his life, within a very short period after operation, from a return of the disease in its worst form. The reproductive powers of the part, if not of the system generally, usually manifest an astonishing activity under such circumstances, and the consequence is that the malady soon accomplishes its work of destruction.

7thly. It is not necessary here to insist upon the propriety of refraining from operation when there is serious disease of an important

internal organ. Such a complication could hardly fail to predispose to relapse, if not to the speedy destruction of the patient.

Reproductive Tendency of Malignant Diseases after Operation.—Of the reproductive tendency of carcinomatous diseases, after extirpation, or destruction by the actual or potential cautery, writers have made mention from the earliest periods of medical science to the present time. Hippocrates was fully aware of the fact; and he entered his protest against all operative proceedings, under the conviction that, however early or well executed, they could not possibly afford any permanent relief, or guard the patient against a return of his malady. Similar views have been advanced by nearly all succeeding writers. If a different sentiment has occasionally been expressed, as has happened in a few instances, it has been by men who have had a very imperfect knowledge of the disease, who have been poor observers, or who have wilfully concealed the truth, from interested and dishonest motives.

The period at which relapse occurs varies from a few weeks to a number of years. On an average, it may be stated to be from four to six months. Occasionally it takes place within an almost incredibly short period. In one of my cases, the malady returned in less than three weeks. The original disease was of eight months' standing, and was seated in the left mammary gland, which it involved nearly in its whole extent; the nipple was somewhat retracted, and there was a slight enlargement of one of the lymphatic ganglions, which was removed in the operation. The dissection was performed with much care, and every particle of the morbid structure was apparently cut away; the greater portion of the wound united by the first intention, but a part of the centre remained open and became the starting-point of the new growth. The woman, who was forty-six years of age, died three months after the operation, after having endured the most horrible torments.

Sometimes a relapse does not take place until the end of the first year; and in a few instances it is postponed to a later period, as the expiration of the second, third, and even fourth year.

All malignant diseases possess this tendency to relapse after ablation, but not in an equal degree. Encephaloid undoubtedly enjoys it to a far greater extent than scirrhus, and scirrhus than colloid. Melanosis also relapses with great frequency and promptness, and may be placed next to encephaloid in this respect. Again, it must be borne in mind that a genuine cancer is more certain to return than a cancroid affection, and, also, that it is more apt to prove rapidly fatal.

The reproductive tendency of malignant disease, after operation, is well illustrated by the following case: A man, aged thirty-two, consulted me in April, 1851, on account of an epulis of the lower jaw, which he had first noticed three months previously; it was firm, elastic, free from pain, of a pale-red color, and attached to the gum and jaw, extending from the ramus to the first bicuspid tooth. Two operations had already been performed upon it, each being followed by rapid relapse. On the 27th of April, I removed the parts, along with the corresponding portion of the jaw. On the 24th of September I operated

upon him a second time, removing the whole of the new growth, which was about the size of a pullet's egg, and about three-quarters of an inch of the anterior extremity of the ramus of the bone, from which the diseased structure seemed to spring. On the 31st of August, 1852, I excised the ramus at the articulation, the disease having attacked its inferior extremity. The man remained well until the winter of 1853, when the disease broke out in front of the ear, and soon formed a tumor of the size of a small fist, from the effects of which he rapidly sank. It is worthy of remark that the general health had been all along pretty good, and that the wound always healed well after each operation.

In a case of cancer of the lip, the particulars of which have been communicated to me by Dr. Barclay, of New York, also five operations were performed, the patient having survived the first excision a little more than seven years. In a case of encephaloid of the thigh, reported to me by Dr. C. S. Tripler, U. S. Army, the man did not die until five years after the first operation. I am acquainted with the history of a number of other examples nearly equally remarkable.

With the renovative tendency of melanosis every one is familiar. Hardly an example of permanent cure by operation is upon record. I recollect a remarkable instance of this recurring action which I witnessed, many years ago, in the practice of the late Professor McClellan, of this city. The disease seemed to have begun in several small subcutaneous tubercles of the abdomen, about the size and appearance of shot, which soon became exquisitely painful, and, gradually bursting through the skin, were at length converted into foul, fungous sores, attended with a highly fetid, sanious discharge. Many of these tumors were extirpated, some in their crude, others in their open state; but, although the wound generally readily healed, they were always promptly succeeded by a new growth in the immediate vicinity of the original. The man became much emaciated, and finally died completely exhausted, with all the evidences of the melanotic diathesis.

When malignant disease returns after extirpation, its tendency, as a general rule, is to assume the encephaloid type. This is true of all the different forms of these affections, whether they reappear at the site of the original disease, in the neighboring lymphatic ganglions, or the internal organs. Hence the reason why the secondary disease is usually so rapidly fatal.

CHAPTER VIII.

SCROFULA.

The term scrofula had formerly a far more limited application than is accorded to it in modern times. It was originally employed to designate a glandular swelling of the neck, strikingly resembling the neck of the swine, whence its derivation. At present, however, it has a much wider signification, being made to include within its range quite a variety of diseases apparently of the most opposite character, yet in reality essentially alike in every particular. As meaning the same thing, the words struma and tubercular disease are frequently used.

The affections which may be comprised under this term are pulmonary phthisis, chronic enlargement of the ganglions of the neck and other parts of the body, hip-joint disease, psoas, lumbar, and chronic abscesses, Pott's disease of the spine, certain forms of follicular ulceration of the mucous membranes, arachnitis, otorrhœa, ozæna, ophthalmia, eczema, and ulceration of the bones. The fact is, the class of scrofulous maladies is almost endless, affecting as they do almost every part of the body, and assuming as they do almost every form of morbid action.

Scrofula consists essentially in the deposition of a peculiar morbid product long known by the name of tubercle. An attempt has lately been made to draw a distinction between the matter of tubercle and the state of the system which predisposes to its occurrence. It is difficult altogether to deny the propriety of this distinction; for there are unquestionably cases which we are in the habit of designating as strumous, where, nevertheless, there is not, so far as we are able to determine, the slightest strumous deposit. There would seem to be merely a strumous irritation in the part, without the part being in a condition to furnish any specific secretion, such as that to which we apply the term strumous, tubercular, or scrofulous.

There is another distinction, which, however, is fast losing ground, which it is more difficult to reconcile than that just mentioned. I allude to the alleged difference between phthisis and scrofula. It would be easy, if a work on surgery were the proper place for discussing the subject, to adduce argument upon argument to show the utter fallacy of this opinion. I have long taught the identity of these diseases, and endeavored to prove that the only real difference between them depends, not upon any difference in the morbid action, but solely upon the difference of structure, tubercular disease sharing the same fate, in this respect, as ordinary inflammation and as the other heterologous

deposits. A tubercle in the lung is essentially the same disease as a tubercle in a bone or a lymphatic ganglion, having the same origin, running the same course, and producing the same results. Why then consider them as different?

Tubercular disease occurs at all periods of *life*. Sometimes, indeed, it exists as an intra-uterine affection, thus leading to the conviction that it is occasionally hereditary, or that it is transmitted in the very act of impregnation. When it occurs as phthisis, it is most common between the twentieth and fortieth year, and it is remarkable that after the age of puberty it exists rarely in any part of the body without involving the lungs. In children, the disease, considered in a general point of view, is most liable to happen between the third and tenth year. A vast majority of the cases of scrofulous disease that are met with in practice, in the form of coxalgia, Pott's disease, caries of the short bones of the extremities, arachnitis, ophthalmia, otorrhœa, tonsillitis, and chronic enlargement of the lymphatic ganglions, occur at this period of life, and constitute an immense source of mortality. It is a remarkable fact that adults seldom suffer from external scrofula; and, on the other hand, it is equally remarkable that children suffer comparatively little from consumption, so common among persons after the age of twenty. In old age the disease rarely occurs in any form.

Struma is frequently *hereditary*. The children of consumptive parents are often cut off by the same disease, or they suffer in various parts of the body, as the bones and joints, the lymphatic ganglions, the eye, ear, and serous membranes. Whole families are sometimes destroyed by it. Occasionally the disease skips one generation, and reappears in another, owing, doubtless, to some temporary improvement in the intermediate offspring.

The tubercular deposit has been observed in nearly every *structure* of the body. The only parts, perhaps, in which it does not occur, are the skin, vessels, nerves, ligaments, aponeuroses, tendons, and voluntary muscles. Of the organs, properly so called, there is not one which is not, at times, its seat. Experience, however, has shown that it manifests a decided preference for certain organs and parts of organs. Thus, it occurs most frequently in the lungs, particularly their summits, then in the lymphatic ganglions, next in the spleen, serous membranes, and mucous follicles of the alimentary canal, then the bones and joints, and finally the liver, kidneys, testes, and false membranes of the serous cavities. Its coexistence in various parts of the body, or its almost universal diffusion, is sufficiently frequent, and constitutes the so-called strumous diathesis.

The deposit occurs both in the interstices and upon the free surfaces of the organs. Hence it exhibits itself in various *forms*, of which the tubercular is by far the most common, the stratiform and infiltrated being, indeed, exceedingly rare. The tubercular variety occurs in little masses, from the size of a millet-seed to that of a pea, of a pale yellowish or grayish color, and of a consistence ranging from that of curds or soft putty to fibro-cartilage, hundreds and even thousands often existing in a very small compass. When very numerous and

closely grouped together, they sometimes coalesce, so as to form a considerable sized tumor. The stratiform variety of the deposit is most common upon mucous surfaces, while the infiltrated is met with chiefly in the lungs, around tubercular excavations, and in the lymphatic ganglions. Whatever shape it may assume, it is always deposited in a fluid state, from which, however, it passes speedily into the solid form, which it retains for a certain period—generally from six to twelve months—when, becoming softened and disintegrated, the part makes an effort to rid itself of it. These changes are followed by the formation of a cavity, named a strumous abscess, of which the best examples occur in the lungs, bones, and lymphatic ganglions. The matter is peculiar; being generally of a yellow-greenish color, of a cream-like consistence, and intermixed with small whitish flakes, very similar to broken-down grains of boiled rice.

Tubercular matter is a direct secretion from the blood, and abounds in the protein principles of that fluid. *Microscopically* examined, it is observed to consist of a transparent matrix, inclosing granules, nuclei, cells, and oil globules, the relative proportions of which vary in different specimens, and even in different portions of the same mass, the chief circumstances which influence its minute structure being the age of the deposit, the nature of the affected organ, and the general condition of the subject. Most of the granules are very minute, and afford an albuminous reaction; they exist in great numbers in yellow tubercle, and often contain so much fatty matter as to be completely dissolved by ether. The free nuclei, or true tubercle corpuscles, are round, ovoidal, oblong, or almost shapeless, and vary in size from $\frac{1}{2500}$ to $\frac{1}{3500}$ of an inch in diameter. They constitute a large proportion of the morbid product, and are generally intermixed with epithelial cells, oil globules, and crystals of cholesterine. The adjoining cut (fig. 50) conveys a good idea of the microscopical characters of tubercle.

Tubercular matter has often been examined *chemically*, and the results that have been obtained all tend to show that, in its crude state, it consists almost entirely of albumen, with a small quantity of earthy salts, particularly phosphate and carbonate of lime. Some specimens also contain a little fibrin, casein, extractive matter, and pyine; but the great and pervading substance is albumen, or protein matter.

Fig. 50.



Tubercle corpuscles. (From a drawing by Dr. Da Costa.)

The microscopical and chemical examinations of this matter are extremely valuable, inasmuch as they go to show the low grade of vitality of this morbid product, and its consequent inability to maintain, for any length of time, its parasitic existence. Certain authors, founding their opinion upon these circumstances, look upon it as an unorganizable substance, very much of the same nature as that of colloid and melanosis. In this view I cannot concur; for I have investigated tubercular matter too often, and under too many circumstances, not to be convinced that it is susceptible of organization, although certainly in a less degree than scirrhus and encephaloid. It is, in point of vitality, a more humble substance than either of these;

it occupies a lower grade in the scale of cell development; and has a greater quantity of protein matter. Nevertheless, we must concede to it a certain degree of life-power, a certain form of organization, otherwise it would be impossible to explain the various changes which it undergoes, and the fact that it occasionally contains distinct vessels, clearly traceable into its interior, and intended to minister to its nourishment and protection. The matter of colloid is very different from that of tubercle, in having no attachment to the cells in which it is contained, in being alike in all stages of its existence, and in never experiencing any transformations. The same is true of melanosis. If this substance is occasionally very hard, it is because of its involvement with its fibrous matrix, or the surrounding tissues. Tubercle, on the contrary, is always firmly adherent to the parts with which it is in contact, except when it is effused upon mucous surfaces, acquires a firm consistence during its development, and often undergoes absorption, or the earthy transformation. Besides, the softening process frequently begins in the very centre of the morbid product, which could certainly not happen if it were an inorganic substance. Those who deny the vascularity of tubercle attempt to account for the occasional existence of vessels by supposing that they become imprisoned in its substance during the progress of its formation. That this view is sometimes true is highly probable, but it is applicable only to certain parts of the body, and then only under certain circumstances. The explanation is undoubtedly not admissible in those cases where the tubercular matter is deposited upon the free surface of the serous membranes or in the substance of the adventitious, where its vascularity is so often observable. This matter, however, is not always organizable. Like coagulating lymph, it is sometimes deprived of its vitality almost in the very act of its secretion. This is particularly the case when it is effused upon the free surfaces of the mucous membranes, especially those of the urinary passages, whose irritating contents speedily render it effete.

Of the exciting *causes* of tubercular disease our knowledge is rather conjectural than positive. It may be fairly inferred, however, from the numerous observations that have been made upon the subject, that, where the tendency to the disease exists, anything calculated to produce excessive debility, or an impoverished condition of the blood and solids, may provoke the morbid deposit. The causes which are most likely to bring about this effect may be thus stated: 1. Meagre and unwholesome diet, deficient in fibrinous, albuminous, gelatinous, and fatty qualities. 2. Protracted disorder of the digestive organs, particularly the various forms of dyspepsia. 3. Exposure to cold, and confinement in damp, ill-ventilated apartments. 4. Exhausting fevers. 5. Excessive and long-continued evacuations of blood. 6. Severe courses of mercury. 7. Stoppage of habitual discharges, as the menstrual and hemorrhoidal. 8. Protracted mental depression. 9. Tertiary syphilis. All these causes act by lowering the vital principle, and diminishing the plastic properties of the blood.

The immediate cause of the disease is inflammation, which regulates, not only the quantity, but also the quality of the deposit. The inflam-

mation is generally of a low grade, and is therefore not characterized by the ordinary phenomena, although it is not the less effective on that account. The reasons which may be adduced in support of this view are the following:—

1. Irritation of the lung, mechanically excited, will frequently give rise to tubercle in that organ, as is occasionally seen in cases of foreign bodies, accidentally introduced through the larynx. In the inferior animals, as the dog and rabbit, mercury dropped into the trachea, will often induce the disease in a short time. Miners, needle-grinders, and weavers, who are habitually exposed to the inhalation of gritty and irritating matter, are particularly prone to phthisis.

2. This view of the origin of the disease is countenanced by the composition of the deposit; for we know of no substance which contains so much albumen, or albumen and fibrin, that is not the product of inflammation.

3. Tubercle bears a great resemblance to coagulating lymph, especially the more degraded forms of that substance, and this, as every pathologist is aware, is always the result of inflammatory action.

4. The disease is often developed under the immediate effects of cold, and various other causes which have a tendency to produce congestion of the internal viscera. Indeed, it is well known that dyspeptics and persons who live upon unwholesome food, or in damp and ill-ventilated apartments, are peculiarly liable to suffer from this disease.

The *duration* of strumous disease is too variable to admit of any accurate general statement. Phthisis, as is well known, usually destroys life in from nine to eighteen months; tubercular arachnitis often terminates fatally in a few days; while external scrofula may last for years, and finally eventuate in recovery.

The *symptoms* vary, of course, according to the nature of the affected structure, but whatever this may be, there are certain appearances which are hardly ever absent in any case. Thus, whether the disease be seated in the lungs, in a bone, a joint, or simply in the cellular tissue, in the form of a cold abscess, there is always, during the progress of the malady, excessive emaciation; for, with the exception of the glandular viscera, the brain, nerves, and a few other structures, there is hardly an organ in the body that does not, in some degree, participate in the general atrophy. The fat gradually but surely disappears; the muscles are pale, flabby, and attenuated; the cellular tissue is deprived of its moisture; the skin is soft and blanched; the hairs grow slowly, and many drop out; the nails are thin, and frequently incurvated; and the bones, although they retain their size, are unusually light, and saturated with sero-oleaginous fluid. The blood also is altered. It is impoverished, thin, light colored, and deficient in globules. The clot is unnaturally small and dense, and, when the disease is fully established, with a tendency to suppuration, is almost always covered with a buffy coat. The fibrin is not materially changed until softening sets in, when it increases disproportionably in quantity, and so continues until suppuration begins, when it attains its maxi-

mum. These changes are generally very conspicuous in phthisis, psoas abscess, and extensive disease of the lymphatic ganglions.

Scrofula has been supposed to be *contagious*, and many experiments have been performed, both upon man and the inferior animals, with a view of deciding the question. In no instance, however, has the operation succeeded. Kortum applied scrofulous pus to sores and wounds in the necks of children, but always failed to induce the disease. Hébreard and Lepéllitier performed similar experiments upon dogs and guinea-pigs with a like result. Finally, Goolad and others attempted, with no better success, to create the disease in their own persons by inoculation. The idea of the contagious character of phthisis was formerly very prevalent, but I am not aware that any respectable pathologist of the present day gives any credence to it.

Persons who are affected with scrofula, or who are laboring under what is termed the *strumous diathesis*, exhibit certain peculiarities, which may be considered as almost characteristic. These refer mainly to the state of the complexion, the condition of the digestive apparatus, and the character of the circulation.

The complexion is generally brunette, and the hair, for the most part, dark, although in both these respects the greatest possible diversity exists. The eyelashes are drooping and of extraordinary length; the pupils are habitually dilated; the upper lip is tumid; the face is pale and puffy; the hands and feet are nearly always cold; the body is unusually impressible by atmospheric vicissitudes; the abdomen is hard and distended; there is a deficiency of muscular strength; and the intellect is dull and sluggish, instead of being sprightly and precocious, as is usually represented. The digestive organs are subject to frequent derangement; the appetite is irregular and capricious; the bowels are either constipated or relaxed, seldom entirely natural; digestion is feeble and imperfect; great annoyance is experienced from flatulence and acidity; and the individual is often a martyr to dyspepsia. Children predisposed to struma are particularly prone to cutaneous eruptions about the scalp, to purulent discharges from the ears, and to chronic enlargement of the tonsils.

There is another class of strumous subjects of a state of mind and body almost the opposite of that just described. The complexion is light and florid, the eyes are blue, the mind unusually active, and the cutaneous circulation quite vigorous. The parts of the body which are most liable to suffer, in this form of constitution, are the bones and joints, the eye, skin, and lymphatic ganglions, particularly those of the neck, consumption being much more rare than in the dark variety.

Scrofulous Ulcer.—Various scrofulous affections of the skin give rise to ulceration, but, perhaps, the most characteristic ulcer of this kind is that consequent upon suppuration of the lymphatic ganglions of the neck, groin, and axilla. Be this as it may, the features of the scrofulous ulcer are so peculiar as to require distinct notice.

The surface of the scrofulous ulcer is always unhealthy, being coated with rough, aplastic matter, of a pale yellowish or grayish color, hard, and firmly adherent to the subjacent structures. There is reason to

believe that this matter, which possesses none of the characteristic attributes of laudable pus, is often intermixed with disintegrated tubercular substance. In many cases the bottom of the ulcer is formed by altered lymphatic ganglions, of a reddish appearance, and so much softened as to break down under the slightest pressure; sometimes, however, they are hard, almost of a fibrous consistence, and as if they had been partially dissected from the surrounding parts. In some cases, in fact, they separate, or slough out, several perhaps coming away at the same time, or in more or less rapid succession. No healthy granulations exist upon such a sore, unless it is in a healing condition, and even then they form and maintain themselves with great difficulty.

The edges of the ulcer are characteristic. They are of a bluish, purplish, or reddish hue, undermined, hard, jagged, thin and sharp at some points, thick and obtuse at others. Occasionally they look as if they were bent in towards the bottom of the ulcer. They are generally remarkably insensible, incapable of forming granulations, and deeply congested, the blood passing through their vessels in a very languid and imperfect manner. In fact, the skin, having lost its support, is excessively impoverished, and has great difficulty in maintaining its vitality.

The parts around the scrofulous ulcer are generally hard, either from the presence of indurated and diseased ganglions, or from interstitial deposits; usually, in fact, from both. The skin is red and congested, and not unfrequently it is considerably œdematous, pitting on pressure. The swelling is often great and disfiguring; in short, characteristic of that peculiar appearance from which the disease originally derived its name, the neck, when that is the affected region, strikingly resembling that of the swine.

The scrofulous ulcer may be single, or there may be more than one; variable in shape and extent, and frequently communicating with considerable sinuses. The discharge is ichorous, or thin and whey-like; sometimes thick and yellowish; in either case, apt to be intermixed with the débris of disintegrated ganglions, flakes of lymph, and broken down tubercular matter.

Treatment.—The treatment of scrofula, like that of cancer, has been exceedingly diversified and empirical, for there is hardly a solitary article of the materia medica that has not, at one time or another, been called into requisition. Even at the present day, when the pathology of the disease is so much better understood, the greatest uncertainty prevails in regard to our therapeutic measures, and the consequence is that few practitioners approach the disease without doubt and misgiving as to the benefit they may be able to confer by their treatment. Strumous affections have always afforded a vast field for the charlatan, and his pretensions have never been more impudently paraded before the public than in our own day. One, if not the chief, reason of this is the fact that so few practitioners really understand the nature of this class of diseases; they seem to forget, or not to know, that they occur in every possible form and under every variety of circumstances, and that, in order to meet them successfully, it is necessary constantly to vary our remedies according to the exigencies of every particular

case. I am certain, from no little experience upon the subject, that the results of our treatment hinge most materially upon our discrimination of the different states of the system under which these affections occur. To treat every case of scrofula alike, without regard to the state of the system which attends it, is the climax of absurdity. Let the practitioner remember that scrofula has no specifics, and he will soon cease to employ his remedies empirically. The indiscriminate use of iodine and cod-liver oil in this affection has done mankind and the profession an immense deal of harm.

It will be sufficient, for practical purposes, to consider scrofulous subjects as being divisible into two great classes, the enfeebled, and the vigorous; that is, those who have but little constitutional stamina, and those who, although affected with a strumous taint, are comparatively stout and robust, possessing a ruddy complexion and an active cutaneous circulation. The latter, undoubtedly, constitute the minority of the cases that come under our observation, but they are, nevertheless, sufficiently common, and so well marked as to be easily recognized by the most superficial observer. Now, to treat these two classes of subjects on the same principle, as is so generally done at the present day, is contrary alike to all the rules of sound sense and daily experience. While cod-liver oil, iodine, and tonics will perform wonders in the naturally weak, they will be of little avail in dislodging and curing the disease in the naturally robust; and, conversely, while the lancet and tartar emetic will be of immense service in the latter, their employment can scarcely fail to be eminently prejudicial in the former. Let it not be understood, however, that one mode of treatment is applicable to all cases of this form or that form of the disease; on the contrary, circumstances constantly arise during the progress of each particular case which imperatively call for a change of remedies, and it is in the knowledge of this circumstance that the great art of curing the malady lies.

It is well, as a general rule, to begin the treatment with some mild but efficient aperient, to clear out the bowels, and improve the secretions. Our course must then be shaped by the peculiarities of the case. If the patient be naturally very feeble, or has become so in consequence of protracted suffering, an alterative and tonic course must at once be instituted, as the most likely to meet the indications; but if, on the other hand, he is strong and plethoric, as denoted by the state of his pulse and complexion, much time will be gained, and structure saved, by the use of antiphlogistics, especially tartar emetic and Epsom salts, in the form of the saline and antimonial mixture, properly guarded with tincture of opium. The lancet must be employed with the greatest care; but I am satisfied that it is often of immense benefit in arresting the morbid action, and that it has fallen into too much neglect in the treatment of scrofulous diseases. In scrofulous inflammation of the eye, throat, and lymphatic ganglions, its effects are often marked and permanent. But there is a time when the employment of antiphlogistics ceases to be proper, and when they may be superseded by other remedies, similar to those generally applicable in the more common form of the disease. If the depletory system of treatment is

carried too far, it cannot fail to do harm by exhausting the vital powers, and thus creating a disposition, in different parts of the body, to the deposition of tubercular deposits.

Among the various remedies that have been employed from time to time for the cure of scrofula, *iodine* holds a prominent rank. This article was first introduced to the notice of the profession, as a therapeutic agent, in 1820, by Dr. Coindet, of Geneva, and since that time its efficacy in the treatment of this affection has received the most ample confirmation. Indeed, it may be regarded as the remedy *par excellence* in this disease. It may be employed alone, or in union with other substances, as potassa, iron, mercury, lead, quinine, barium, and ammonia, and hence much judgment is often required to determine what particular form of the remedy is best adapted to a particular case or form of the malady. As a general rule, it may be observed that when a purely alterative effect is desired, it may be exhibited by itself, in substance, in tincture, or in the form of Lugol's concentrated solution, consisting of one scruple of iodine and double that quantity of iodide of potassium, dissolved in seven drachms of water. Of this the patient may take from five to ten drops every eight hours, in a wine-glassful of sweetened water, the dose being gradually increased to fifteen, twenty, twenty-five, and even thirty drops, according to the tolerance of the system.

With the same view the *iodide of potassium* is not unfrequently administered alone; and, when scrofula is associated with constitutional syphilis, rheumatism, or mercurial disease, it certainly constitutes one of the best forms in which iodine can be exhibited. With whatever view it may be employed, it is proper always to begin with small doses, as four or five grains, if the patient be an adult, and gradually to increase them to ten, twenty, and even thirty grains, three or four times a day. The most eligible way of giving it is in water, or in union with the fluid extract of sarsaparilla. Some patients take it very well in hop tea, and when there is much restlessness at night, or nervous irritation, this is perhaps the best form in which it can be exhibited.

When the liver is at fault, or when there is a syphilitic taint of the system, or much disorder of the secretions, the *protiodide of mercury* may be advantageously prescribed, in doses varying from the fourth of a grain to half a grain, three or four times a day. The *biniodide* may be employed with the same view, but it should be recollected that it is much more potent, and that, therefore, greater caution should be observed in its administration. The dose, which at first should never exceed the one-twelfth or one-sixteenth of a grain, may be gradually augmented to a fourth or even half a grain, given in the form of pill, or dissolved in alcohol.

When an alterant and tonic effect is indicated, nothing can be better than the *iodide of iron*, or the iodide of quinine. The former of these articles is one of the most valuable anti-scrofulous remedies that we possess, and one which rarely entirely disappoints expectation. In my own practice I have found it particularly beneficial in strumous disease of the cervical ganglions, of the upper lip, the eye, and joints.

I often give it in solution, but more commonly in the form of pill, in combination with quinine and opium. If vascular action be present, a minute portion of tartrate of antimony and potassa may be added to each dose. In children, who cannot take pills well, the best mode of administering it is in combination with syrup of orange-peel, or syrup of sarsaparilla. The *iodide of quinine* has been employed in the treatment of scrofulous tumors, in cases where iodine and tonics are indicated, in doses from one to two grains every six or eight hours.

In whatever form iodine be employed, whether as a simple or compound, it must be borne in mind that the system should be free from all vascular excitement, and that, after it has been exhibited for a fortnight, it should be pretermitted for several days, when it may be resumed, and given as before. Employed in this manner it exerts a much happier influence upon the progress of the complaint, and is much less likely to disagree with the stomach and bowels, than when given uninterruptedly. In case it acts as an irritant, it must be exhibited in smaller doses, or be combined with opium or hyoscyamus. Great mischief often results from neglect of this precaution.

Another remedy from which I have often derived signal benefit in the treatment of scrofulous diseases is *barium*. It has repeatedly succeeded in my hands when other means have proved inefficient or entirely unavailing; I regard it as particularly valuable in chronic enlargement of the cervical ganglions, both before and after the establishment of suppuration. It is chiefly adapted to patients with a languid circulation, a pale tallow-like complexion, a flabby tongue, indigestion, and cold extremities. Its use is contra-indicated when there is inflammatory excitement, or congestion of any important organ. The best mode of administration is the officinal solution of the United States Pharmacopœia, beginning with six or eight drops, and gradually but cautiously increasing the dose to ten, twelve, or fifteen drops, three times a day, in a wine-glassful of hop tea, or half an ounce of the simple syrup of sarsaparilla. Exhibited in large quantities, it is liable to cause nausea, heartburn, diarrhœa, griping, headache, rigors, and profuse sweats; in a word, all the symptoms of mineral poisoning. There is an *iodide of barium* which is worthy of trial in scrofulous affections. The dose is one-eighth of a grain three times a day, gradually increased to one, two, or even three grains.

There is no medicine which has been more frequently or more extensively employed in the treatment of strumous diseases than *mercury*. The preparations most commonly used are calomel, blue mass, corrosive sublimate, and the black sulphuret, or Ethiop's mineral. Of these the bichloride is the best. It should be given in minute alterative doses, as the one-sixteenth or one-twentieth of a grain, three times a day, either in the form of a pill, or along with sarsaparilla. Thus administered, it yields hardly in efficacy to iodine, and is probably superior to barium. In employing mercury, in any form, care should be taken that the system be properly prepared for its reception, and that it be not carried so far as to induce salivation. If it be found to act as an irritant or excitant in any way, it must be at once discontinued, or exhibited in smaller quantity. Whether mercury produces

its beneficial effects merely by correcting the secretions, and thereby improving the general health, or by suspending or modifying the tubercular action, we have no means of knowing.

When the disease has existed for a considerable length of time, and especially when there is a decided tendency to emaciation, great benefit may be expected from the use of *cod-liver oil*, given in half ounce doses thrice in the twenty-four hours, in good ale, or along with a little brandy. The efficacy of this remedy is no longer a matter of doubt, but rests upon the general testimony of the profession. Although it contains a minute quantity of iodine and bromine, it is probable that its good effects depend chiefly upon its nutritive qualities. However this may be, it unquestionably improves the condition of the digestive organs, and acts slightly upon the urinary and cutaneous secretions. To derive much benefit from it, its use must be continued, steadily and persistently, for a long time.

Whatever remedies may be employed, the closest attention should be paid to the bowels, diet, exercise, and dress. Constipation should be counteracted by mild aperients, as blue mass and rhubarb, or, when there is much disorder of the secretions, by a few grains of calomel, followed by a little oil. Active *purgation*, however, must be studiously avoided, as it will inevitably do mischief by inducing debility. Torpor of the liver must be promptly met by mild mercurials, and acidity by alkalies, of which bicarbonate of soda, either alone, or in union with a little ginger, is the most valuable. The alkalies were at one time much in vogue in the treatment of scrofula, in the belief that they possessed a kind of specific power, but their influence was evidently much overrated. Emetics are occasionally of service, especially when there is much nausea, depraved appetite, and headache.

The *diet* of a scrofulous patient should be light, unirritant, and rather nutritious than otherwise. It should consist principally of the farinaceous articles, with milk or weak tea at breakfast and supper, the latter of which should always be very light, and taken at least three hours before retiring to bed. Coffee, fresh bread, pastry, and everything else of an indigestible nature must be proscribed. The food should be well masticated, and never used in such quantity as to oppress the stomach. In the latter stages of the malady, or even earlier, if the strength seems to require it, some of the lighter meats, a little fresh fish, or a few oysters may be taken once a day, along with a glass of porter, ale, sherry, port, or Madeira, or, what is better than all, of brandy and water. Sometimes an almost purely animal diet seems to agree best with the stomach.

As an important auxiliary means *exercise* claims particular attention. It may be taken on foot, in a carriage, or on horseback, as may be most convenient or agreeable to the sufferer, and should always be indulged in whenever the weather admits of it. Care is taken that it is never carried to fatigue. In bad weather, the patient may use dumbbells, or amuse himself in sawing wood, planing, or anything else to which he may have access. Children should be carried about in their nurses' arms or in handcarts.

Particular attention must be paid to the patient's *clothing*. He must

be warmly clad. Flannel should be worn next the surface, both summer and winter, the feet should be protected with thick shoes and stockings, and the skin should be maintained in a healthy, perspirable condition by frequent ablutions with tepid water, impregnated with common salt, ground mustard, strong soap, or any other exciting substance. A change of air is sometimes of vast service, and has been known to be almost of itself sufficient to effect a cure in this disease. The locality selected should be as healthy as possible, and not liable to great or sudden variations of temperature. The atmosphere should be dry, not loaded with moisture, and when this is the case it matters little whether it is cold or warm, provided it does not run into either extreme. A residence near the sea-shore is often of immense benefit.

In the latter stages of the disease, when the patient is harassed with hectic fever and diarrhœa, the treatment must be of a tonic and stimulant character. The diet must be highly nutritious; porter, ale, wine, and milk-punch must be freely used; the bowels must be restrained with astringents; the excessive sweats must be controlled with quinine and elixir of vitriol; and sleep must be procured and pain allayed with anodynes.

There is no doubt that the state of the *mind* is capable of exercising a powerful influence upon the cure of scrofula, especially when seated in the external parts of the body. We may assume this to be a fact from the astonishing benefit which so often followed the royal touch, a practice which is said to have originated in the time of Edward the Confessor, near the middle of the eleventh century, and which continued down to the reign of Queen Anne. The belief in the efficacy of the royal touch seems to have been a long time almost universal in Britain. It was particularly prevalent in the reign of Charles II., who, in one single year, touched nearly 100,000 persons, who flocked to him from all parts of England, Ireland, Scotland, Jersey, and Guernsey. The practice was generally accompanied by prayers and other religious ceremonies, and particular days and seasons were set apart for its observance. The effect of this singular remedy was variable; in some of the patients a cure followed almost immediately after they were touched; in others, the relief was more tardy, but in the end not the less effectual; occasionally the process was obliged to be repeated; and in some cases the treatment was entirely useless. Richard Wiseman, who was surgeon to Charles II., and a most sagacious observer, must have had great confidence in the efficacy of the royal touch; for he expressly declares that "His Majesty cured more persons of scrofula in one year than all the chirurgeons of London in an age."

The *local treatment* of scrofula merits some attention, although it can be alluded to here only in a very general manner, as each affection comprised under this denomination requires a mode of management in some respects peculiar to itself. The most important topical remedies are leeches, blisters, issues, pustulation with croton oil, tincture of iodine, embrocations, and sorbefacient unguents, especially such as have iodine for their bases, as the iodides of mercury, lead, potassium, iron, barium, and zinc. Leeches are often of immense service; and, as to counter-irritants, they can rarely be dispensed with in any case.

Of the various sorbefacient applications none holds a higher rank, in my opinion, than the tincture of iodine, either pure, or, as I generally prefer, considerably diluted with alcohol. It is used as in ordinary inflammation, and often exerts a powerful influence upon the progress of external scrofula, especially of the joints and cervical ganglions. Blisters, too, are a valuable means of relieving local congestion, modifying capillary action, and removing morbid deposit. If the part affected be a joint, rest, long and faithfully continued, will be necessary, if, indeed, not indispensable. If abscesses form, they must be opened, with the precaution, if possible, of excluding the atmosphere, experience having shown that such ingress is highly prejudicial, not on account of anything noxious in itself, but because of its tendency to cause decomposition of the contents of the sac, and, consequently, violent reaction, or hectic irritation. The swelling is attacked in its most depending part, the knife being introduced in a valve-like manner, and the opening immediately closed with adhesive strips, supported by a compress and roller. The practice of permitting such accumulations to continue until they have seriously impaired structure, and caused intense suffering, cannot be too pointedly condemned.

The scrofulous *ulcer* must be treated rudely at first, and gently afterwards. The undermined edges are cut away with the knife or scissors, and the surface is thoroughly touched with dilute acid nitrate of mercury, the solid nitrate of silver, or sulphate of copper, the application being repeated every other day until there is an appearance of healthy granulations, when milder means, such as opiate cerate, or the dilute ointment of nitrate of mercury, take its place. If disintegrated ganglions are present they should be removed with the knife, or destroyed with the Vienna paste; for so long as they remain no substantial progress can be made towards a cure. Sinuses are traced out with the bistoury, unless they involve important structures, when stimulating injections, or the seton, must be used instead. Valuable aid will often accrue in these cases from the daily application of the dilute tincture of iodine to the surface immediately around the ulcer.

CHAPTER IX.

WOUNDS.

SECT. I.—GENERAL CONSIDERATIONS.

The term wound is a generic one, being employed to designate all injuries attended with a division of tissue, inflicted by sharp, pointed, or blunt instruments and weapons of every description. The breach, or solution of continuity, may be apparent or concealed; that is, upon and in the skin, as well as in the more deep-seated structures, or the skin may retain its integrity, and the wound be strictly subcutaneous.

Wounds are constantly made by surgeons in the legitimate exercise of their professional duties, as in the removal of limbs, tumors, and urinary calculi, and in the restoration of lost or mutilated parts. In general, however, they are inflicted accidentally, and hence, as this may happen in a great variety of ways, they are very properly arranged under different heads, according to the manner in which they are produced. Thus, a wound is said to be incised when it is caused by a sharp instrument; lacerated or contused, when it is made by a blunt body; and punctured, when the weapon is narrow and somewhat pointed. A gunshot wound is a breach inflicted by a ball. In a poisoned wound the tissues are inoculated with some peculiar virus, either secreted by an appropriate apparatus in the bodies of certain animals, as the bee or snake; contained in the salivary fluid, as in the dog in hydrophobia; or developed after death, as in the human subject in the dead-house. The term penetrating is employed when the wound communicates with a cavity, as a joint, the chest, or the abdomen.

Wounds are also generally named according to the region of the body which they occupy, or the particular tissues, organ, or cavity which they affect and interest. Thus we are accustomed, in common parlance, to speak of wounds of the head, neck, chest, abdomen, and extremities; of wounds of the skin, muscles, tendons, vessels, and nerves; of wounds of the stomach, heart, lungs, liver and brain; and of wounds of the joints, pleura, pericardium, and peritoneum.

Finally, wounds may be superficial or deep; recent or old; simple or complicated; oblique, transverse, or longitudinal. The meaning of these terms is too obvious to require any particular explanation. The most common complications which attend their occurrence, or which arise during their progress, are, hemorrhage, the presence of foreign matter, abscesses, mortification, erysipelas, pyemia, and tetanus. These accidents, whether in their individual or combined capacity, often completely change the character of a wound, rendering complex

what was originally perhaps perfectly simple, and dangerous what was, in the first instance, perhaps so insignificant as hardly to attract serious attention.

The characteristic features of wounds will be pointed out in connection with the different classes of injuries to which they refer. The prognosis and treatment will also receive due attention. I shall therefore content myself here by stating, in general terms, that the great and leading indications, in every wound, whatever may be its nature, are, first, the stoppage of hemorrhage; secondly, the removal of extraneous matter; thirdly, accurate approximation and retention of the edges of the solution of continuity; and, lastly, the prevention of inflammation, tetanus, and other untoward occurrences. In every case, the most prompt attention should be given; the parts should be handled in the most cautious and gentle manner; and the dressings, which are never to be too officiously interfered with, should always be as light as possible. In short, whatever is done, should be done with a view to the most speedy and perfect restoration of the injured structures.

1. MODE OF DRESSING WOUNDS.

The most important retentive means are adhesive plaster and sutures, aided, if necessary, by the bandage and attention to the position of the wounded parts.

There are various substances which are endowed with adhesive properties, and which are therefore well adapted to retain the edges of a wound in contact with each other. Those, however, which are usually employed for this purpose are the common adhesive plaster, collodion, and isinglass.

The old *adhesive plaster* is composed of resin and lead plaster, in the proportion of one part by weight of the former to six parts of the latter, melted together over a gentle fire, and spread smoothly by machinery upon muslin, which is rolled up, and kept in the shops ready for use, care being taken to protect it from the heat. The addition of a little soap renders it more pliable, and prevents it from cracking in cold weather, without impairing its adhesiveness. To attain the same end, some pharmaceutists are in the habit of incorporating with it spirits of turpentine, but such an addition is highly objectionable, as the plaster, when thus prepared, is liable to irritate the skin, and thus induce a tendency to erysipelas and the development of small ulcers, to say nothing of the probability of its interfering with the adhesive action of the wound.

The plaster, when intended to be used, is cut into suitable strips with a pair of scissors, carried in the direction of the length of the cloth, not in that of its breadth, as it is much more yielding in the latter than in the former, and therefore liable, when it becomes heated on the skin, to let the edges of the wound gap more or less. Trifling as this precept may appear, I consider it to be of great practical importance, and am satisfied that it is much less insisted upon than it should be. When the wound occupies a limb, each strip should be

long enough to extend about three-fourths round it; on no account should it completely encircle it, lest it obstruct the return of venous blood, and at the same time cause pain and tension. The width of each strip should be uniform, and should vary, on an average, from half an inch to an inch, according to the exigencies of each particular case.

Previously to applying the plaster, the surface of the skin should be divested of hair, and well wiped with a dry cloth, as the least moisture prevents it from adhering. The shaving of the parts is necessary to facilitate the removal of the plaster, which would otherwise be difficult and painful, and which might, by its traction, even seriously compromise the safety of the adhesive process. These important preliminaries being disposed of, bleeding having ceased, or nearly so, and the edges of the wound being carefully held together by an assistant, each strip is heated by holding its back against a pitcher or coffee-pot filled with boiling water, and then applied in such a manner as that its centre shall correspond with the wound, each extremity firmly grasping the opposite side. If the wound is very long and deep, the first strip should be stretched across its middle, which thus becomes the starting point of all the rest. The interval between each two strips should not, on an average, exceed the eighth of an inch, as this will afford ample space for the drainage of blood, serum, and lymph, of which there will generally be more or less after every injury of this description, especially if it be of considerable extent. Care must be taken that the adhesive strips are laid down in as smooth and even a manner as possible; hence, the parts should always be put in the position in which it is intended to keep them during the treatment. If the strips turn up in folds, or are partially detached, they should be immediately replaced by others, more skilfully applied. Finally, care must be taken, on the one hand, not to invert the edges of the wound or to draw them together too firmly, and, on the other, not to approximate them so loosely as to endanger their partial separation. In short, everything must be done in a neat, accurate, workman-like manner.

Much has been said of late years respecting the value of *isinglass* plaster; it is alleged that it is more bland than the common plaster, that it is quite as adhesive, and that it possesses the additional advantage of not provoking irritation, which the other undoubtedly sometimes does, especially in persons of a delicate, sensitive skin. Moreover, it is claimed that isinglass, when spread on gauze, will, by its transparency, admit of complete surveillance of the wound, thus enabling the surgeon to witness the changes going on in and around it. Notwithstanding these supposed advantages over common adhesive plaster, my conviction is that the latter, as prepared by the modern pharmaceutist, is decidedly superior to it, in every particular. The idea that common adhesive plaster is apt to cause erysipelas and ulceration of the skin is in great measure, if not wholly, chimerical; at all events, it has seldom fallen to my lot to meet with such occurrences. In the next place, it is much stronger than isinglass plaster, and therefore it affords better support to the parts. Thirdly, it is less liable to become prematurely detached; and, lastly, although it is opaque, yet as there is always an interval left between each two strips for drainage, it is

obvious that it cannot in the slightest degree interfere with the examination of the wound and its vicinity. I, therefore, as a general rule, limit the use of isinglass plaster to the dressing of small wounds or little cuts, and employ the common plaster for wounds of large size. The principles regulating its application do not differ from those already laid down. The strips should be of appropriate length and width, and moistened on the glazed surface with a sponge wet with hot water.

The credit of having introduced *collodion* for surgical purposes is due to Dr. J. P. Maynard, of Boston, by whom it was first used in 1847. It is a solution of gun cotton in ether, assisted by a little alcohol, and is a transparent, colorless fluid, of a syrupy consistence, which, when applied to a dry surface, allows of the rapid escape of the ether, leaving a thin, bluish film, possessed of remarkable adhesive and contractile properties. Being impervious to water, it is less liable to be prematurely detached than isinglass or common resin plaster. Put upon wounds or abraded surfaces, it produces sharp pain, which, however, speedily subsides, and does not afterwards return. It may be applied by means of a camel-hair pencil, or a small brush, directly to the affected parts, as in the case of small, superficial cuts; or upon strips of silk gauze, or patent lint, of suitable width and length, when the wound is so large and deep as to require firm support. As the ether evaporates very rapidly, the dressing should be applied with as much celerity as possible, everything being thoroughly arranged beforehand, and the edges of the wound well dried and supported by an assistant. Personal observation induces me to believe that collodion makes an excellent dressing in solutions of continuity about the neck and face, or in all the more movable regions of the body, and in those cases where it is particularly desirable to exclude the contact of the air.

Within the last few years *caoutchouc* has been pressed into the service of the surgeon on account of its adhesive qualities; an excellent sticking plaster may be prepared from it by spreading a solution of it, with a stiff brush, upon gauze silk, or thin calico, after the fashion of collodion. One great advantage which it possesses over most other materials is that it is completely impermeable by water.

Whatever substance be employed, it should be allowed to remain on so long as it seems to answer the object for which it was applied. The moment, however, it becomes a source of irritation, loses its hold, or interferes with drainage, it should be removed; but before this is done the new substitute should always be in full readiness, so that the parts may not be unduly exposed to the air, before the dressing is renewed. Surgeons, I think, often err in being too anxious to meddle with the adhesive plaster; too early interference has a tendency to interrupt the adhesive process, and may, in persons of bad, irritable constitutions, give rise to erysipelas and other accidents. I have, more than once, after severe operations, retained all the adhesive strips for upwards of a fortnight; until, in fact, complete cicatrization had taken place. Such good luck, however, is rare; and it more generally happens that the dressings, plaster and all, have to be changed at the end of the second, or, at farthest, of the third day. Much, of course, will depend,

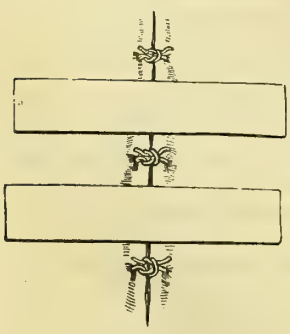
in every case, upon the state of the weather, the size and situation of the wound, and the amount and character of the discharges.

When the wound is extensive, only a few strips should be taken off at a time, otherwise we shall endanger the separation of its edges. Before the dressing is reapplied, the parts should be thoroughly cleansed with tepid water, pressed from a sponge held some distance off; no wiping must be done, nor must the wound be roughly squeezed. If there is matter at its bottom or between its edges, it should be pressed out in the most gentle and careful manner; for it must not be forgotten that all rough manipulation is not only painful but injurious to reparative action. Sometimes the necessary cleanliness may be readily effected with a moist sponge or soft cloth passed lightly over the surface. Great skill is required in removing the plaster to the best advantage of the parts. Each strip should be raised by taking hold of one extremity with the thumb and finger of one hand, while the other hand is engaged in supporting the wound; the other end being treated in a similar manner, the portion corresponding with the wound is lifted off last, and thus all danger of injury is effectually obviated.

The principal sutures employed in surgery are the interrupted, twisted, continued, and quilled. To these may be added the important modifications introduced by Professor Pancoast, namely, the plastic suture, as he terms it; the clamp suture of Dr. Sims; and the button suture of Dr. Bozeman; all of which will receive proper attention, in connection with plastic operations and the treatment of vesico-vaginal fistule.

The *interrupted suture*, which is more frequently employed than any other, is made with a needle, either straight, or slightly curved, and armed with a single, well-waxed ligature, either of silk or linen, as may be found most convenient; for, in a practical point of view, it is really altogether immaterial which it is. The instrument, which should be very sharp, and spear-shaped, is introduced through the edge of the wound, from without inwards, at a suitable distance from its surface, and then pushed from within outwards at precisely the same point at the opposite side, leaving the thread in its track. A second stitch is then to be taken in a similar manner, and thus the operation is continued until a sufficient number has been introduced, when the ends of each ligature are to be tied with a reef-knot, and cut off close. The distance at which the needle should be inserted from the wound must of course vary in different cases and in different regions of the body; but, in general, it should not be less than half a line, nor more than a quarter of an inch. The depth at which it is passed should be such as to admit of accurate approximation of the wound, about one-third of the thickness of the edge being behind and the rest in front of the needle. In no case of superficial wound should the instrument

Fig. 51.



embrace muscular or aponeurotic substance. The interval between each two stitches must also necessarily vary, according to circumstances, from a few lines to an inch or more, and should be supported, after the sutures have been tied, with adhesive plaster, as seen in the annexed wood-cut (fig. 51). When the wound is very small, it may be sewed up with a common cambric needle, and a proportionately delicate thread.

The *twisted suture* is made by introducing a needle through the edges of the wound, and passing a thread round it, so as to confine it in its place. It makes an admirable retentive apparatus, but it is of more limited application than the interrupted suture. From the fact that it is generally employed in the treatment of hare-lip, it is often called by that name.

Various instruments are employed for making the twisted suture. The one to which I give the preference is what is called the lady's toilet pin, consisting of a round steel pin, very sharp-pointed, and furnished with a glass head; it readily penetrates the tissues, and creates less irritation than the common sewing needle, formerly so much employed for this purpose. Twenty-five years ago surgeons were in the habit of using a silver needle, with a movable steel point, as seen in the annexed wood-cut (fig. 52); a cumbersome, awkward instrument, now

Fig. 52.



happily discarded. Dieffenbach recommended what is called the insect pin, which, however, has never come into general vogue, at least on this side of the Atlantic. In small wounds of the forehead, face, and neck, in which it is of so much importance to avoid a scar, I have been in the habit, ever since I entered the profession, of employing a very delicate gold pin, with a head of sealing-wax, and there is not, I am sure, any article better suited to fulfil such a purpose. Insusceptible of oxidation, it causes no irritation, and may therefore be retained an unusual length of time, without detriment to the parts.

Whatever instrument may be employed, transfixion is effected in the same manner as in the common interrupted suture. The wrapping material is also similar, the thread varying in thickness according to the particular object to be attained. It is wound round the pin elliptically (fig. 53), as it arranges itself much more evenly and smoothly when thus applied than when applied in the form of the figure 8 (fig. 54), as recommended in the books. As many pins or needles having been inserted as may be deemed advisable, the threads are passed from one to the other diagonally across the gap, so as to effect complete apposition there also, and so obviate the necessity for using adhesive plaster.

Fig. 53.

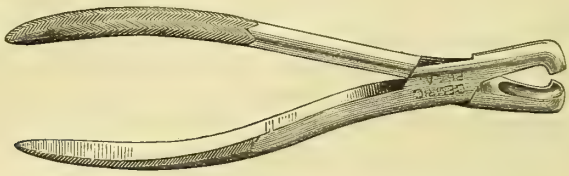


Fig. 54.



Finally, the ligatures being tied, the operation is completed by cutting off the points of the pins with a pair of forceps, delineated in the adjoining sketch (fig. 55), the object being to prevent them from hurting the patient, or being caught in his clothes.

Fig. 55.

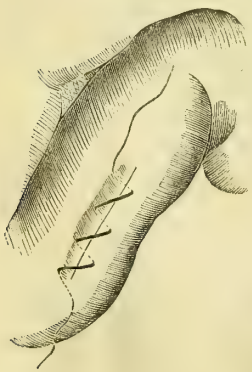


Pin pliers.

The time during which the pins are retained varies from thirty-six hours to three or four days, according to the circumstances of the case. Their removal should be effected with great care, in a direction contrary to that of their introduction, the parts being well supported at the time. The threads being generally firmly glued to the surface and edges of the wound, are allowed to remain until they drop off of their own accord, which usually happens in a day or two after. The support thus afforded is often of great service to the imperfectly organized bond of union, and its premature removal sometimes necessitates the employment of adhesive plaster, or the insertion of a new pin.

The *continued suture* (fig. 56) is similar to that used by the glover, on which account it is generally known as the glovers' suture. It is made with a needle armed with a suitable thread, which is passed diagonally from one side of the wound to the other, on the same principle as in the interrupted suture. Its use is almost exclusively restricted to the treatment of wounds of the intestines, where it will again be noticed.

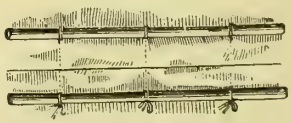
Fig. 56.



The glovers', or continued suture.

The *quilled suture* (fig. 57), so called from the fact that it was originally made with the assistance of two quills, is employed chiefly in the treatment of lacerations of the perineum, with a view of effecting more even and accurate contact of the opposed surfaces. The older surgeons were in the habit of using it in sewing up deep muscular wounds, as those of the thigh and abdomen. No one, however, thinks of resorting to it for such a purpose at the present day; for in the latter case, the

Fig. 57.



The quilled suture. The dotted lines mark the course of the ligature beneath the integument.

object can be attained much more easily by the ordinary interrupted suture, extending down nearly to the peritoneum; and in the former by methodical support with the compress and bandage.

The quilled suture is made by passing a stout double thread through the sides of the wound, at intervals of an inch or an inch and a half, and tying its ends over a piece of bougie, quill, or wood, lying parallel with the cut, but about half an inch from it.

Although sutures undoubtedly act as foreign bodies, necessarily exciting a certain degree of irritation in the parts in which they are inserted, yet I have by no means that dread of them which they seem to have inspired in the minds of many practitioners. It has rarely happened to me to witness any ill effects from their employment, and in those cases in which this event did happen the fault, I am inclined to believe, was due more to the indiscretion of the surgeon, or the want of stamina on the part of the patient, than to any untoward operation of the sutures themselves. Provided the threads, or needles and threads, are clean, of suitable size, and properly inserted; the constitution of the patient in good condition; and the wounded structures in a tolerably sound state; it is difficult to understand how they could become a source of serious irritation, much less of erysipelas or severe ulceration; effects which have been all charged to their action. My rule has therefore always been to use them freely, and to allow them to remain as long as they seem to answer the purpose for which they were introduced. The moment this object is attained, or they are found to be productive of injury, they should be withdrawn.

A great deal has lately been said about metallic sutures, or sutures made with the silver wire, special attention having been called to the subject by Dr. Sims, of New York, who evidently puts a high estimate upon their supposed value. It is perhaps too soon to give anything like a definite opinion upon the subject; but I must confess that in my own limited experience I have not realized from them the great advantages that this distinguished surgeon has been led, from the results of his own observations, to ascribe to them. The introduction of the wire is easy enough, but its withdrawal is often attended with great inconvenience, and even risk of tearing the imperfectly united edges of the wound completely asunder. Nor am I satisfied that it is less irritating than the properly prepared silk or linen thread. Doubtless, the subject will receive farther attention, so that, ere long, we shall probably be able to place a proper estimate upon the real value of this variety of suture.

Much benefit is often derived, in the treatment of wounds, from attention to rest and *position*. If the part be exercised, or subjected to motion, it will be difficult, if not impossible, to preserve apposition, to say nothing of the greater tendency which is thus established to undue inflammatory action. If the wound be transverse, and seated in an extremity, it will be impossible to prevent it from being torn open, unless the muscles which pass along it are maintained in a relaxed condition. Thus, if the wound involve the front of the thigh, the limb is extended, and flexed, if it affect the posterior aspect. In

each case, the muscles, immediately concerned in the lesion, are put in a state of perfect repose.

In very large and deep wounds, it is hardly possible to keep the edges in contact, in their entire extent, without the aid of compresses and *bandages*. Let us suppose that the injury is seated in the thigh, and that it is accompanied by extensive division of the muscles. In such a case, adhesive plasters and sutures, however skilfully applied, would scarcely be sufficient to give the wound the support which is necessary to keep the deep portion of the edges in apposition with each other. More or less separation would almost be inevitable. To fulfil this indication, so important to the adhesive process, it is indispensable to lay a stout compress along each side of the limb, opposite the deep part of the wound, and to confine it with a roller, extending from the toes upwards as far nearly as the groin. In all wounds of this description, whether the result of accident or of operations, great care must be taken to prevent the retention of fluids, otherwise suppuration will take place instead of union by the first intention. Large intervals should be left between the adhesive strips, and holes should be cut in the bandage where it lies over the affected part; in some cases it will even be proper to leave a small tent at the bottom of the wound, bringing it out at the most dependent point, to drain off the discharges.

2. MODE OF HEALING OF WOUNDS.

The parts having been properly adjusted, the duty of the surgeon, as far as manipulation is concerned, is temporarily at an end. Nature, the physician of wounds, as she was called by Paracelsus, must do the rest. "Warily," says this eccentric man, in his "Great Surgery," published in 1536, "warily must the surgeon take heed not to remove or interfere with Nature's balsam, but protect and defend it in its working and virtue. It is the nature of flesh to possess in itself an innate balsam which healeth wounds. Every limb has its own healing in itself; Nature has her own doctor in every limb; wherefore every chirurgeon should know that it is not he, but Nature, who heals. What do wounds need? Nothing. Inasmuch as the flesh grows from within outwards, and not from without inwards; so the surgery of wounds is a mere defensive, to prevent Nature from suffering any accident from without, in order that she may proceed unchecked in her operations." If these sentiments, uttered more than three centuries ago, could only be firmly impressed upon the mind of the modern surgeon, there would be much less meddlesome practice of every kind than there is now, notwithstanding our boasted knowledge, and our contempt for the fathers of the profession.

Modern surgeons have described five distinct modes according to which wounds are supposed to heal. The first is by immediate union, or the direct growing together of the raw surfaces; the second, by scabbing, or the formation of a crust of blood covering over the wound; the third, by the effusion of lymph, and the conversion of this into fibro-cellular tissue; the fourth, by granulation, and the development

of epithelial matter; and the last, by the junction or inosculation of the granulations with each other. The old doctrine, so ably advocated by Hunter, and so long entertained by practitioners generally, assumes that there are but two modes of cure; the one consisting in union by the first intention, or primary adhesion, and the second in the formation of granulations, filling up the gap, and thus repairing the injury, the last stage of the process being the development of new skin. This latter mode of repair constituted what was so long known in the schools as union by the second intention, or union by granulation.

The idea that *immediate union* of a wound may take place was first advanced by Dr. McCartney, of Dublin, and is now prominently taught in all the British schools of surgery, if not also in those of this country. It assumes that two raw surfaces, laid closely and evenly together, will promptly coalesce with each other, independently of inflammation and effusion of lymph or blood, vessel inosculating, as it were, with vessel, muscular fibre uniting with muscular fibre, skin adhering to skin, and nerve becoming again continuous with nerve. It is alleged, it is true, that this occurrence is uncommon, and that it requires for its production a good constitution, an entire absence of local inflammation, and the greatest possible caution in respect to the management of the parts. When these conditions are present, it is asserted that even large wounds are capable of this kind of union; and a case, observed by Mr. Paget, is usually referred to as an illustration and proof of the possibility of such an occurrence. This case is briefly as follows: A female, aged thirty-three, had had her breast and several axillary glands removed on account of cancer. The flaps, which were very large, were carefully approximated, and kept in place with isinglass plaster; the general health seemed to be excellent, and union took place in the ordinary way, the whole line of incision having firmly closed by the end of the third week, except at one narrow spot, at which granulations arose from the pectoral muscle. Erysipelas and phlebitis now set in, and carried off the patient in four or five days.

"I cut off," says Mr. Paget, "the edges of the wound with the subjacent parts, expecting to find evidence of union by organized lymph, or, possibly, blood. But neither existed; and the state of the parts cannot be better described than by saying that scarcely the least indication remained of either the place where the flap of skin was laid on the fascia, or the means by which they were united. It was not possible to distinguish the relation which these parts held to each other from that which naturally exists between the subcutaneous fat and the fascia beneath it. There was no unnatural adhesion; but as the specimen, which is in the Museum of St. Bartholomew's, will still show, the subcutaneous fat which did lie over the mammary gland was now connected with the fascia over the pectoral muscle, just as, for example, the corresponding fat below the clavicle is naturally connected to the portion of the same fascia that lies there. The parts were altered in their relations, but not in their structure. I could find small points of induration where, I suspect, ligatures had been tied, or where, possibly, some slight inflammation had been otherwise excited; and one small

abscess existed under the lower flap. But with the most careful microscopic examination, I could discover no lymph, or exudation corpuscles, and only small quantities of what looked like the débris of such oil particles or corpuscles of blood as might have been between the cut surfaces when the flaps were laid down. In short, we cannot otherwise or more minutely describe this healing than by the term "immediate union;" it is immediate, at once in respect of the absence of any intermediate substance placed between the wounded surfaces, and in respect of the speed with which it is accomplished."

No one, it seems to me, can examine the history of this case without being struck with the fact that it was just such an one as must, of necessity, have been followed by inflammation and a deposit of fibrin; the operation was evidently a severe one, the dissection was extensive, the relations of the parts were completely changed, and it is impossible to conceive that the flaps, although carefully laid down and confined by isinglass plaster, could have united without the intervention of plastic matter. If the use of the knife is ever productive of inflammation, it surely ought to be under such circumstances. That inflammation was present, is proved by the circumstances, referred to by the reporter, that there were several little points of induration apparently corresponding with the site where ligatures had been applied, and mention is also made of the existence of a small abscess, clearly denotive of the same fact. Thus, then, it is perfectly certain that both inflammation and deposit of lymph had occurred at several places, and it may be imagined, without any stretch of the imagination, that nature had treated the rest of the wound in a similar manner, with this difference only that less lymph was effused there than elsewhere. The union, too, was more prompt and effectual. Hence, long before the woman expired, the plastic matter, poured out as a consequence of the amputation of the breast, was completely absorbed, having fulfilled its purpose as a bond of connection between the opposed surfaces; so that, when the parts were examined with the microscope, not the slightest trace of it could anywhere be discovered. Different textures, it is well known, possess different faculties of furnishing plastic matter, as well as of removing it after it has been deposited. Thus, in amputation of the leg, when the flap is exposed to the air, we observe that muscles, fibrous membrane, skin, and cellular tissue are much more rapidly glazed with lymph than adipose substance, vessels, or bone, the latter of which, in fact, rarely exhibits any evidence of its presence until the end of the first week, and then it always shows itself first on the medullary membrane, then on the cancellated structure, and lastly on the outer compact substance.

Now, if we take into consideration all the circumstances that can be brought to bear upon this question; the fact that all injuries whatever are followed by inflammation, if the patient survives their effects long enough, as well as by more or less effusion of lymph; that some structures take on this action more readily than others; that inflammation is often slight in one part and severe in another; and that lymph, when no longer of any use, is invariably absorbed, nature abhorring a substance which she does not need, as in the case of a wound after the

completion of the solidifying process; taking, I say, all these circumstances into account, I am satisfied that it is impossible for any wound, however induced, situated, or treated, to heal by immediate union, or without the intervention of inflammation and effusion of lymph.

The only case, it seems to me, in which such a mode of union would be at all possible, is where the edges of a wound, as, for instance, one of the hand, are carefully approximated immediately after the receipt of the injury, thus affording the vessels and other structures an opportunity of promptly regaining their natural relations. But even here it is more rational to conclude that the vessels, irritated and fretted by the injury they have sustained, would pour out a thin film of lymph, serving as a bond of reunion between the divided parts.

The second mode in which a wound is said to be capable of healing is by the process of *scabbing*, and here also, it is alleged, the cure is effected without the intervention of inflammation, or the deposition of plastic matter. An injury of this kind being inflicted, the blood coagulates upon its surface, where it soon forms a hard, solid crust, which thus protects it from the contact of the air and other injurious influences until it is covered over with new skin, when nature's shield being no longer required, is cast off as an effete substance. This mode of healing, which is occasionally imitated by the surgeon's dressing, consisting of lint dipped in blood, or smeared over with collodion, is rare in man, but sufficiently common in the inferior animals, as the horse and cow, owing to their being so much less liable to active inflammation and its consequences. The principal proof deduced by the advocates of this mode of cure rests upon the supposed fact that inflammatory deposits occurring in a case of this kind would effectually destroy the process by prematurely detaching the scab, and so leading to the development of granulations, or union by the second intention. No one, however, has ever demonstrated that there is no inflammation when a wound is incrusted in this way; on the contrary, the whole theory is a mere speculation, unsupported by a single proof. The difference between such a wound and an ordinary open one, is simply this, that, in the former, there is very little inflammation, whereas in the latter, there is a good deal, but in neither is it wholly absent.

With regard to the third mode of cure, or union by *adhesive inflammation*, all pathologists stand upon the same ground, none disputing the possibility of its occurrence. The only conditions which it demands for its speedy and successful accomplishment are, first, that no coagulated blood shall intervene between the contiguous surfaces, and, secondly, that the part and system shall be maintained in such a state as not to permit the inflammation to transcend the limits of lymphization. According to this doctrine, union cannot take place without more or less inflammation and the effusion of a certain amount of plastic matter, serving as a bond of connection between the opposed surfaces, glazing and gluing them together, and ultimately, after having enjoyed the properties of nucleated blastema, assuming the character of cellulo-fibrous tissue. Now, if the views which it has been my object all along here to inculcate be correct, it follows that all union is the result of adhesive action; that is, of a certain degree of

inflammation just sufficient, and no more, to pour out the requisite amount of coagulating lymph for effecting the cohesion of the raw surfaces. If the quantity of this substance is very small, or its vitality greatly impaired, no union will occur; nor will such an event take place if the effusion be attended with high excitement; for under such circumstances the lymph that is poured out will be aplastic and associated with suppuration, causing the parts to gap and compelling them to heal by granulation or union by the second intention. In the more favorable cases of adhesive inflammation, the intervening substance is soon removed by absorption, without being transformed into cellulo-fibrous tissue, which can only be needed when the union is tardy, or when it is affected through the medium of an inordinate quantity of plastic material; when, in short, the apposition has been somewhat imperfect, and yet not sufficiently so as to offer any serious obstacle to cohesion, or to cause suppuration. In general, when the process of reunion goes on kindly, the merest conceivable film of lymph is sufficient for the purpose; the vessels, nerves and absorbents soon extend from one side to the other across the intervening substance, and as soon as coalescence has occurred, and complete interchange has been established, the new matter, now no longer needed, is speedily removed, precisely in the same manner and for the same reason that the callus is removed after the union of a broken bone; nature, as already stated, being averse to letting anything remain that is not needed if she can get rid of it.

The fourth mode according to which wounds may heal is by the *granulating process*, or union by the *second intention*. This occurs in all cases where the adhesive inflammation is thwarted, whether in consequence of defective action, mismanagement, or any other cause whatsoever. The surface of the wound gaping, it gradually becomes covered with granulations, by which the cavity is ultimately filled up, cicatrization constituting the last act of the process. The manner in which these bodies are formed, as well as their structure and their functions, having already been considered under another head, nothing further need here be said respecting them.

Finally, the new doctrine teaches that a wound may heal by the direct conjunction of granulations, or by a kind of *secondary adhesion*. This mode of cure, it is alleged, may occur whenever we place in contact the edges of an open wound, thereby bringing the granulations more closely in apposition, and so favoring their coalescence, coherence, or direct growing together. To my mind this mode of union does not differ from the ordinary process which we notice during the development, aggregation, and adhesion of granulations upon the surface of wounds and ulcers; hence, if this opinion be correct, such a distinction is as unnecessary as it is unscientific. I question, however, whether there is, in either case, anything like a direct adhesion; on the contrary, it seems more probable that whenever granulations unite they cohere through the medium of a thin film of plastic matter, as is the case with the raw surfaces of a recent wound, as previously described, and which is rapidly transformed into nucleated blastema, or germ cells, which thus form the basis of new tissue.

If what has now been said be correct, it follows, as a necessary corollary, that there are only two modes in which wounds unite, long recognized by surgeons, easily comprehended, and in perfect harmony with the results of observation and experience. These two modes are, as was previously stated, adhesive inflammation, or union by the first intention, and repair by granulations, or union by the second intention; in other words, there is no form of union without inflammation and lymph; and the only difference in the two processes here mentioned is that in the one the plastic matter serves as a direct bond of connection between the opposed surfaces, while in the other it is converted into a series of elaborately organized bodies which, by their coalescence, ultimately fill up the gap left by the retracted edges of the wound.

A subcutaneous wound heals on the same principle as an open one, only that the contact of the atmosphere being excluded, there is less inflammation. Inflammation, however, is never, as some have asserted, entirely absent; for we always find after the operation of tenotomy, an operation which supplies us with one of the best examples of this class of lesions, that the parts continue to be sore and tender for some time afterwards, and that, as when the tendo-achillis has been divided, the person walks with great difficulty, or, as more generally happens, is altogether disinclined, if not actually unable, to move about. The lymph that is poured out here is highly organizable, and is therefore readily transformed, at first, into nucleated blastema, then into cellulo-fibrous matter, and ultimately into tendinous tissue, closely resembling that which it serves to unite.

SECT. II.—INCISED WOUNDS.

An incised wound is a solution of continuity inflicted with any sharp cutting instrument, as a knife, a sword, or an axe. It may vary in extent from the slightest possible incision to a gap of frightful length and depth. The largest lesions of this description are generally made designedly by the surgeon in the extirpation of tumors, in the amputation of the limbs, and in the resection of joints. In general, they are open, and therefore in contact with the air; but in some instances they are subcutaneous, and therefore exempt from such exposure. Every incised wound, however simple, is characterized by three phenomena, deserving of special consideration; 1st, by an effusion of blood; 2dly, by more or less pain; and 3dly, by a retraction of the edges of the divided structures.

1st. The *hemorrhage* varies in quantity, from a few drops to several ounces, or even quarts, according to the extent of the injury, and, above all, the vascularity of the affected tissues. When the capillaries alone are involved, the blood oozes rather than flows away, whereas the reverse is the case when a tolerably large vessel is divided. The hemorrhage may be strictly arterial, but in general it is both arterial and venous. In the former case, the fluid is of a scarlet color, and spirts out in jets, synchronously with the contraction of the heart; in

the latter, on the contrary, it is of a dark modena, or purple complexion, and issues in a continuous stream, as in bleeding at the arm. Some parts of the body being more vascular than others, are naturally inclined to bleed more when divided. Thus, a wound of the cheek bleeds more freely than one of the leg, and both less than one of the lip. Again, a part that has been habitually irritated for a long time will, when divided, emit a much greater amount of blood than it will if it be in a healthy state. A familiar example of this occurs in excision of the tonsils, an operation which is sometimes attended with profuse hemorrhage, in consequence of the enlargement of the vessels, and their inability to retract on account of inflammatory effusions.

2dly. The *pain*, like the hemorrhage, attendant on an incised wound, is influenced in its extent, by the size of the lesion, the nature of the affected textures, and the temperament of the individual. In general, it very soon subsides, and does not afterwards return, unless there is an undue amount of inflammatory action. When a large nerve has been implicated in the injury, there is usually some degree of numbness in the surrounding tissues, and occasionally partial paralysis in the distal parts.

3dly. The *retraction* of the edges of the wound is dependent upon the natural resiliency of the cutaneous and muscular tissues. It is very materially influenced, however, in its degree, by the depth of the wound, by its situation, and also by the amount of motion to which it may be subjected immediately after the receipt of the injury. Thus, a wound of the hairy scalp, extending down to the bone, will scarcely gap any, while one on the forehead, arm, or leg will exhibit a frightful cavity, in consequence simply of the muscular contraction of the part, or, in the case of the two latter, on account of the change of posture.

The *treatment* of such an injury is perfectly simple. The first object is to arrest the hemorrhage, provided this has not been already done by the natural efforts. In all cases where it is of a capillary character it soon ceases spontaneously; or, when this does not happen, it may be promptly stopped by exposing the surface of the wound to the cold air, or by pressing upon it a sponge wet with cold water. When, on the other hand, it proceeds from a vessel of considerable size, the more prudent course will be to apply the ligature; for, although it may be temporarily suppressed, yet it will be very liable to break out again upon the slightest exertion; or, at all events, as soon as reaction takes place. The manner of performing this operation will be pointed out under its appropriate head.

The hemorrhage having been arrested, the next thing to be attended to is the cleansing of the wound. Every foreign substance, no matter how delicate or minute, must be carefully picked away with the forceps, removed with the fingers, or dislodged with a stream of water squeezed from a sponge. The finest hair, if allowed to remain, would act as an irritant, and impede the adhesive process. The same remark is applicable to the blood that may cover the wound, or incrust its edges. It is just as necessary to remove this as it is to remove dirt or any extraneous substance whatever. Even the slightest possible layer of blood is likely to prove a barrier to immediate reunion; for although

it is unquestionable that this fluid may occasionally become organized, yet such an event is never expected or wished for under such circumstances. Hence the whole surface of the wound should be thoroughly freed of blood, not roughly, of course, but as gently as possible, before we attempt the approximation of its edges. If the blood has coagulated and become adherent to the wound, it may be readily detached with the fingers, forceps, or handle of the scalpel. Finally, the circumjacent parts, if covered with hair, are carefully shaved and washed.

The object of these preliminaries is to place the wound in the best possible condition for union by the first intention, or the establishment of the adhesive process. To insure this, the edges must be carefully approximated in their entire extent, and retained in contact for a certain period, by appropriate means, aided by rest and proper position of the part. If the wound be of small extent, nothing will be required beyond a strip or two of adhesive plaster. If, on the other hand, it is long and deep, it will probably be necessary to use, in addition, a few sutures, if not, also, a compress and bandage.

The wound being dressed, and the parts concerned placed at rest in a relaxed, and, if possible, also in an elevated position, little remains to be done by the surgeon, except to watch and assist nature in her reparative efforts. Within a short time after the edges of the wound have been approximated, inflammation is set up, and this is speedily followed by an effusion of plastic lymph, not only upon their surface, but also into the surrounding tissues. The interposed layer, hardly as thick as the most delicate spider's web, soon becomes organized, by an interchange of vessels and nerves between the opposite sides, and thus forms the bond of union between the divided structures. In the meantime the inflammation gradually subsides, the surrounding tissues regain their accustomed functions, and the consolidation is completely established. The resulting cicatrice remains rough for some time, but by degrees it becomes polished, and finally assimilates itself to the natural skin, except that it is whiter, free from hair and sebaceous follicles, and less capable of resisting the effects of disease.

But it is not always that the healing process advances so favorably, as might be inferred from the above statement. In many cases, indeed, it is materially retarded, interrupted, or even entirely prevented. Various causes may contribute to bring about this untoward result; but the most common are, the presence of some foreign body in the wound, or the want of accurate apposition of its edges, too much motion in the part, improper applications, or an undue amount of morbid action. It is the duty, therefore, of the practitioner not only to attend well to every case of the kind in the first instance, but to watch it most sedulously throughout its entire progress, inciting action when it is deficient, and repressing it when it is too high.

If the symptoms assume an untoward tendency, the adhesive action threatening to pass into the suppurative, the sutures and plasters should immediately be slackened, and recourse be had to the water-dressing, either warm or cold, simple or medicated, according to the tolerance of the part and system. In general, simple water will be found to answer better than anything else, and may often be advan-

tageously employed from the very commencement, especially if the wound be very large, in anticipation of inordinate action. The diet, bowels, and secretions must be properly regulated; and if suppuration be inevitable, the most agreeable and soothing application will generally be a light emollient cataplasm. Gaping of the wound should be counteracted by the use of adhesive strips, aided by position, and, if necessary, by a few loose stitches and the bandage.

SECT. III.—LACERATED WOUNDS.

A lacerated wound is a lesion in which the tissues, instead of being smoothly divided by a sharp cutting instrument, are torn rudely and forcibly asunder. The edges are ragged and irregular, there is little pain or hemorrhage, and the surrounding parts, frequently bruised and discolored, are cold and benumbed. The injury most commonly occurs in factories, grist-mills, and steam-boats, from the clothes and limbs being accidentally caught in the machinery. Extensive lacerations are often caused by weapons of war;. by the teeth of the inferior animals, as the shark, dog, and bear; by the passage of the wheel of a cart or carriage; and by falls from a considerable height, in which the body strikes against a hard and projecting object, as a stone, a post, or an iron-railing.

A lacerated wound differs from an incised one, 1st, in the slightness of the attendant pain; 2dly, in its indisposition to bleed; 3dly, in its tendency to suppurate and slough; and, 4thly, in its liability to be followed by tetanus and other nervous symptoms.

The *pain* in lacerated wounds is generally very trifling; indeed, instances are frequently met with in which it is entirely absent, the patient being unconscious at the moment and for some time afterwards of having received any serious injury. Thus in the case of Wood, the miller, as detailed by Cheselden, the arm was torn off at the shoulder, and yet so slight was the pain that the man was not aware of what had occurred until he observed the limb moving round on the wheel. I have seen several instances in which the tendons of the fingers, along with a portion of their muscular bellies, were pulled out with such velocity as not to be productive of the least local distress, the patient not being conscious of having been injured until a short time after the accident. When the lesion is very grave and extensive, as when a limb is suddenly severed from the trunk, the attendant shock must necessarily be so severe as to obliterate, in great measure, all local sensation. Upon the occurrence, however, of reaction, the pain becomes frequently very violent, requiring large doses of anodynes for its suppression.

The absence of *hemorrhage* in a lacerated wound forms a very striking feature, and is the direct consequence of injury done to the vessels. In an incised wound there is no impediment to the flow of blood, because the vessels are divided evenly; in a lacerated one, on the contrary, they are torn into shreds and fragments, which readily intercept the fluid as it sweeps over them, and thus promote the for-

mation of a coagulum, often extending high up into the tube. The vessels, moreover, are partially paralyzed, from the injury sustained by the nervous filaments of the affected parts; hence they are incapable of contracting upon their contents and of propelling them onwards. In addition to these circumstances, there is frequently, especially in severe lacerations, excessive prostration of the system, which powerfully contributes to the coagulation of the blood, and the formation of an internal clot. This indisposition to hemorrhage is present even when very large vessels are wounded. In the celebrated case of Wood, above alluded to, the arm was torn off along with the scapula, and yet there was no hemorrhage. Many instances of a similar kind have been published, among the more remarkable of which are those related by La Motte, Morand, Carmichael, Mussey, Gibson, and Allan.

Lacerated wounds are frequently deceptive in their appearance, the amount of injury being much greater than the surgeon is at first led to suppose. The skin, for example, may be affected very slightly, perhaps, indeed, hardly at all, while the muscles, aponeuroses, vessels, and even the nerves may be extensively severed, or torn up. In many cases the bones are crushed, large joints laid open, and the soft structures completely pulpified. Hence too much caution cannot be observed in our examinations, as well as in our prognosis.

The *treatment* of a lacerated wound is to be conducted upon the same general principles as that of an incised one. All extraneous matter is removed, the vessels, if necessary, are tied, the parts are neatly approximated, and every precaution is used to moderate the resulting inflammation. In applying the ligature, care is taken to select a sound portion of the artery, otherwise secondary hemorrhage will almost be certain to follow the sloughing process. When the hemorrhage is venous, it may, in general, be promptly and effectually arrested by the compress and roller, which should be so arranged as not to impede the return of the blood to the heart. All undue constriction must be avoided. Ligation is rarely called for, even when the largest veins are torn across. Although it is not probable, from the ragged character of the wound, that much of it will heal by the adhesive process, yet it is always best to treat the case with reference to this object. For this purpose the edges, after having been neatly trimmed, are lightly approximated, and maintained by adhesive strips, supported by a bandage; all tension is carefully avoided; and large interspaces are left between the plasters for the purpose of drainage. Sutures may usually be dispensed with, although I have not the same dread of them that some surgeons have; for I have, in many cases, derived the greatest benefit from their employment, while I have rarely seen them do any harm. They should never be retained longer than forty-eight hours, and they may be removed even earlier, if they appear to act injuriously. If any parts are entirely deprived of vitality, they may at once be cut away, but as there must generally be some uncertainty on the subject, it is a good rule to let them alone, and intrust their separation to the efforts of nature; or, at any rate, to wait until it is perfectly certain that they have perished.

To moderate the inflammation, the water-dressing is used, either

warm or cold, as may best comport with the comfort of the patient. On the appearance of suppuration it may, unless acting very kindly, give way to the linseed cataplasm, which, in its turn, is superseded as soon as the granulating process is fairly established, by the opiate cerate. If the inflammation run very high, threatening to terminate in gangrene, purgatives and nauseants are freely used, and leeches applied to the parts immediately around the wound. The lancet is rarely required, except in very robust and plethoric subjects, in whom, under such circumstances, it cannot be resorted to too early or hardly too vigorously. Mercury is frequently indicated at the very commencement of the treatment, on account of the concomitant derangement of the biliary and digestive apparatus, produced by the shock of the injury. It should be administered in moderate doses, either alone, or in combination with opium, Dover's powder, or morphia and antimony. Anodynes must be freely given to allay pain and insure sleep. Much judgment is required not to carry the depletion too far. In all cases due allowance must be made for the waste which must necessarily attend a wound of this description, as well as for the depression which the system experiences in the first instance, and which often continues to exert its baneful influence for days and weeks together.

Secondary hemorrhage may arise as soon as reaction takes place, or it may be postponed until the sloughs begin to separate. In the latter case, it will not be likely to occur before the fifth or sixth day. When there is reason to expect such an event, as there will be when a considerable sized artery is implicated, the patient should be most sedulously watched until the crisis is past, a tourniquet being placed loosely around the limb, and the nurse instructed in its use, so as to be fully prepared to meet the emergency the moment it arises. For the want of such precaution life might be destroyed in a few minutes, before it is possible for the attendant to reach the bedside.

Tetanus is most frequently met with in nervous, irritable subjects during the prevalence of hot, or damp, chilly weather, and often arises without any obvious cause, either as it respects the wounded part or the system. Large doses of anodynes, especially of opium and assafœtida, will usually promptly arrest it in its earlier stages, but when fully developed it almost always proves fatal, no matter what treatment may be employed.

When the laceration is seated in an extremity and involves important vessels and nerves, or when it is accompanied by a comminuted fracture, a compound dislocation, or a disorganized state of the soft parts, the probability is that amputation will be required. Should this be decided upon, the proper period for performing the operation is as soon as reaction is fully established. If it be undertaken while the patient is pale, faint, and nearly pulseless, he will be almost certain to die from the immediate shock of the operation, or, at all events, within a few hours after, from an inability to recover from the effects of it. On the other hand, the amputation should never be postponed until the system has been assailed by inflammation, since this would equally compromise the result. The time for interfering, then, is when the heart has resumed its wonted action, the pulse reappeared at the wrist, the

color returned to the face, and the warmth been re-established in the extremities; then, but not until then, do we operate.

SECT. IV.—CONTUSED WOUNDS.

A wound is said to be contused when the parts, instead of being neatly divided by a sharp instrument, are bruised and severed by an obtuse body, its edges being ragged and shreddy. The injury may happen in a great variety of ways, as a blow with a heavy bludgeon, the kick of a horse, the passage of the wheel of a carriage, the contact of a partially spent ball, or the explosion of a gun, shell, or rocket. An ugly contused wound is occasionally received by a fall from a considerable height, in which the person alights among sharp and disjointed stone, upon a pile of timber, or upon a mass of rubbish. The most severe accident, however, of this kind is that which follows the passage of the wheel of a railroad car, in which the body is often mangled in the most frightful manner, the soft parts being literally pulpified and the bones ground to pieces.

The effects of a contused wound are various. When the injury is very severe life may be destroyed on the spot, just as in a gun-shot wound, from shock or loss of blood, and without any attempt whatever at reaction. In the milder forms, however, the consequences may be very trifling. From the manner in which the structures are bruised there is generally but little pain in the first instance and for some time afterwards; the part feels merely stiff and benumbed, perhaps somewhat sore and tender; by and by, however, when inflammation arises the pain is often considerable, while in some instances it is extremely severe. When the injury is extensive, there is always great shock to the whole system; the patient is deadly pale, and almost bereft of consciousness, with hardly any pulse at the wrist, and great coldness of the extremities. When he recovers from this state he is apt to suffer from vomiting and various nervous disorders. If the weather be hot, or the constitution unusually irritable, he may be seized with locked jaw. Neuralgia is also liable to occur as a sequel of such accidents.

Another peculiarity of the contused wound is the trifling *hemorrhage* which usually attends it; resembling, in this particular, the lacerated and punctured wound. The vessels being bruised and paralyzed, are unable to propel their contents, which, in consequence, almost instantly coagulate, thus opposing an effectual barrier to the effusion of blood, which is also, at the same time, in many cases, if not generally, deprived of its vitality in the midst of the injured and perhaps pulpified tissues. When, however, the lesion is very slight, the vessels are sure to throw out more or less blood, although the flow is never copious, except when a considerable sized artery has been laid open, when it may be so great as to prove fatal in a few minutes. Much, then, will depend, in every case, as far as bleeding is concerned, upon the extent and particular character of the lesion sustained by the coats of the vessels, and also, but in a minor degree, upon the injury inflicted upon the blood itself.

Although there is frequently little or no bleeding in a wound of this kind immediately after its occurrence, yet there is generally, if the injury be at all extensive, great danger of secondary hemorrhage. The period at which this will be likely to happen is when the sloughs begin to separate, which, on an average, will be from the fifth to the tenth day, according to the size of the breach and the amount of the concomitant contusion. Hence, as in lacerated and gunshot wounds, the patient should always be diligently watched during this period, lest, hemorrhage coming on unexpectedly, he should perish before he can obtain assistance.

Contused wounds rarely heal by the first intention; the parts are too much bruised to enable their vessels to pour out plastic matter; the inflammation is often extremely severe, and the surgeon is fortunate if he can restrain it within the limits of suppuration, and prevent the occurrence of gangrene. The latter event is by no means uncommon when the lesion is at all severe, and there are few cases of the kind in which more or less tissue is not deprived of vitality during the infliction of the injury. Under such circumstances sloughing will of course be inevitable.

Lesions of this kind are often followed by large abscesses, particularly when they occur upon the scalp, on the hands and feet, and deep among the muscles of the thigh, abdomen, back, and shoulders. The pus is sometimes extensively diffused beneath the muscles, and is frequently preceded by erysipelatous inflammation, especially in nervous, irritable, and intemperate individuals.

Serious injury is occasionally inflicted upon the trunk or upon a limb, without any outward evidence whatever of the fact, perhaps not even the slightest bruise, scratch, or discoloration of the surface. Such accidents are most frequently caused by the passage of the wheel of a carriage, the kick of a horse, machinery in rapid motion, or the blow of a cannon ball, and are easily accounted for by the elasticity of the common integuments, which enables them to glide out of the way of the vulnerating body, while the other and deeper-seated structures, which are destitute of this property, are sometimes completely destroyed by its contact, the vessels and nerves being cut to pieces, the muscles torn into shreds, the bones mashed, and the largest joints laid open. The scalp is sometimes extensively detached from the cranium by a fall upon the head without any external wound, and a partially spent cannon ball, striking the belly obliquely, has been known to tear open the bowels, spleen, and liver, without leaving any mark or trace whatever upon the skin. Such injuries, which are, to all intents and purposes, subcutaneous wounds, are peculiarly severe, and are liable to be followed by the worst consequences; often proving fatal on the instant, or, subsequently, from the effects of inflammation.

Differing from the lesions now described are what may be called, in the strict sense of the term, *contusions*, that is, injuries of the organs and textures without any actual division of substance, except upon a small scale, implicating chiefly the more minute vessels and nerves, along with the connective tissues. Of this form of accident the "black eye," the result of pugilistic rencontre, affords an excellent

illustration; as does also the bruise upon the scalp from a blow with a stick. The immediate effect of such an injury is an extravasation of blood from the rupture of the smaller vessels of the part, and more or less discoloration of the surface, usually of a reddish, bluish, or purplish tint, with a sense of numbness and a dull, heavy pain. The quantity of blood poured out varies from a few drops to many ounces, according to the extent of the lesion, the size of the vessels, and the nature of the affected structures; it is seldom considerable, unless there is an abundance of cellular substance, when it may be very great, as well as widely diffused. When the fluid presents itself as an infiltration, it constitutes what is technically called an *ecchymosis*, of which we have a good example in the extravasation which occurs in the submucous cellular tissue of the conjunctiva after a blow upon the eye in an ordinary fight. If, on the other hand, the blood is collected in a small circumscribed spot, the affection takes the name of "thrombus," while the term "depôt" is employed to designate it when it is large and concentrated. This distinction is not without its practical value, and therefore deserves to be borne in mind. The accumulations of blood which occur on the child's head, and in the labium of the mother, during severe and protracted labor, are good illustrations of a sanguineous depôt, which is often met with upon a large scale in severe contusions, both with and without wound. When the extravasation is copious, it is to be assumed, whatever may be its form, that it has been caused by the rupture of some of the larger vessels, and hence such an occurrence should always be regarded as one of a serious character, often placing limb and life in jeopardy.

In the *treatment* of contused wounds three leading objects are to be kept in view; the first is to arrest hemorrhage, the second to limit inflammation, and the last to promote the absorption of effused blood.

The hemorrhage is to be controlled in the usual manner; by compression and cold applications, if it be slight, or venous, and by ligature, if it be copious and arterial. When the bleeding vessel is concealed, as when the wound is subcutaneous, it may be extremely difficult to find it, owing to the bruised and injected state of the parts, which often renders the search one of great labor and annoyance; still, it is our only resource, and the sooner, therefore, the operation is performed the better, for it will certainly not at all facilitate the undertaking if we wait until the supervention of inflammation. If the obstacles be unusually great, or if, in our attempt to tie the artery at the seat of injury, we should be compelled to interfere with important structures, it will be well to secure the vessel at some distance above the wound; trusting that the recurrent bleeding will cease spontaneously, or under the influence of systematic and persistent compression.

Although we can hardly expect to obtain much, if any, union by the first intention in a contused wound, still it will do no harm to try; for such an attempt will certainly not make matters any worse. We should, therefore, always proceed as if such an occurrence were not only practicable but probable; with this view the edges of the wound should be as nicely approximated as possible, care being

taken of course not to draw them together at all tightly; for due allowance must be made for swelling and drainage, which will always be more or less considerable in this class of lesions. No fear need be entertained respecting the use of sutures, provided they be introduced loosely, and not too numerously. I never hesitate to employ them in such cases, with the restrictions here specified, and am not aware that I have ever seen any ill effects from them. It is only when they produce tension, or when they are made to embrace improper tissues, that they are likely to prove prejudicial. The same remarks are applicable to adhesive strips; they cannot be dispensed with, but it is plainly our duty to apply them with great care, and in such a manner as to leave free room for the escape of fluids. Some authors advise that the edges of the wound should be neatly trimmed prior to their approximation, but such a procedure is never justifiable unless it is perfectly clear that the tissues are dead, or unless they are so ragged and irregular as to render it impossible to effect accurate apposition. It will generally be well to intrust this matter to nature, permitting her to do as she may consider best.

A few sutures and adhesive strips are usually the only dressings that will be required. The parts, having been properly arranged, should be kept constantly wet with evaporating lotions, of which alcohol and water, in the proportion of one part of the former to five of the latter, will generally be the best. Weak solutions of acetate of lead or Goulard's extract will also be serviceable. Such cases are generally benefited by slightly stimulating applications, which seem to have the power of giving tone to the weakened vessels, and thus warding off erysipelas, which is so frequent a result of this lesion when treated in the ordinary manner. Leeches and iodine may become necessary when the inflammation is very active, and in this case too a poultice will generally be found to be more grateful than cold water or astringent lotions. The bowels must be maintained in a soluble state; but the greatest care must be taken to guard against severe purgation, and, in fact, against all active depletion. Due allowance must be made, in every case, for the profuse discharges which are so liable to follow contused wounds. If mortification should occur, the treatment will not differ from that consequent upon ordinary inflammation. Pain and nervous symptoms are controlled by anodynes and antispasmodics. When granulations begin to spring up the milder ointments will come in play, and will advantageously supersede the warm and cold applications; the former proving now too relaxing, and the latter too repressing.

The removal of extravasated blood is best promoted by cold astringent lotions, such as acetate of lead, Goulard's extract, alum, and hydrochlorate of ammonia. After the lapse of a few days the part may be frequently bathed with tincture of arnica, spirits of camphor, or soap liniment; painted with the dilute tincture of iodine; or covered with a poultice made of the crumbs of bread and common salt, or of the bruised roots of briony. Under this treatment an ordinary ecchymosis will often vanish in a few days; but in the more severe cases a much longer time may be required.

When the extravasated blood appears in the form of a depôt, or as a concentrated collection, attended with marked tension of the integuments, the speediest way of getting rid of it is to make a small opening, just sufficient to permit the blood to drain off, if it be fluid, or to be squeezed out, if it be coagulated. The walls of the sac are then approximated by a compress and bandage, and irritation is kept down by the ordinary antiphlogistic means.

SECT. V.—PUNCTURED WOUNDS.

A punctured wound is a peculiar injury, deriving its name from the nature of the instrument with which it is inflicted, and the manner in which the tissues are divided. It comprehends all those lesions which are produced by nails, splinters of wood, thorns, pins, needles, pieces of bone, or fragments of glass; or by the thrust of a dirk, bayonet, lance, sword, or any other sharp-pointed weapon. The operation of tapping affords a familiar instance of such a wound. The sting of the bee, wasp, and other insects, and the bite of the snake, dog, rat, and other animals are all examples of this class of injuries, with this difference, however, that most of them are inoculated with the peculiar poison secreted by these creatures, and hence they naturally come to be considered separately. In common, every-day life, punctured wounds are most frequently met with in the hands and feet of the working classes. In dissecting and sewing up dead bodies the physician often punctures his fingers, and sometimes suffers severely in consequence, apparently, from the introduction of a peculiar septic virus, generated either during the act of dying or shortly after death.

Punctured wounds vary much in their extent, direction, and character; thus, they may be superficial or deep, narrow or wide, straight or crooked, simple or complicated; circumstances which will necessarily exert more or less influence upon their prognosis, treatment, and termination. Their depth is usually much greater than their width; hence it is often extremely difficult to determine the amount of injury done to the parts in which they are situated.

A punctured wound is peculiar, not only as it respects the mode of its production, but also in regard to its effects. The tissues are forcibly pressed asunder, and, consequently, more or less contused, if not also a good deal lacerated. The wound made by the bite of man and the inferior animals is usually both a punctured and a lacerated wound; so also when a splinter of wood, or a similar body, is violently driven into the flesh during an engagement on shipboard, or when a person is suspended by a hook or impaled upon a railing. A needle, nail, or bone, on the contrary, usually makes a purely punctured wound.

The *pain* attendant upon such an injury is frequently most excruciating, depending evidently, not so much upon the extent of the lesion, as upon the injury sustained by the nerves of the part, and the bruised and condensed state of the tissues. Hence the suffering, which is often immediate, is sure to be immensely increased if the resulting

inflammation is at all severe. It is always greatest, other things being equal, in persons of a nervous, irritable temperament. Much also will depend, in this respect, upon the nature of the vulnerating body. The puncture, for example, made in the operation of tapping the abdomen with a trocar generally causes but little uneasiness, while that of a nail, penetrating the sole of the foot, deep down among the muscles, usually produces the most intense agony. Violent nervous symptoms often supervene upon such accidents, and in hot climates, as well as in the hot seasons in the colder latitudes, they are liable to be followed by tetanus, especially among negroes and the more intemperate classes of whites.

Punctured wounds are rarely attended with much hemorrhage, indeed frequently hardly any at all; if a large artery, however, has been penetrated, then the bleeding may not only be copious, but fatal, and that perhaps on the instant. The thrust of a sword, lance, dirk, or bayonet in the chest, abdomen, neck, or thigh, often literally taps the vessels, destroying the patient in a few minutes. The shock of such a lesion, too, may prove to be of consequence; even a slight puncture is sometimes followed by excessive prostration, and it has been found that soldiers, during engagements, are seldom able to continue the fight beyond a few minutes after they have been deeply pricked by the point of any of these weapons. The shock of the system is excessive, and the patient soon falls into a fatal syncope.

Another peculiarity of punctured wounds is their liability to be followed by *erysipelas*, angeioleucitis, abscess, contraction of the limbs, and wasting of the muscles. Mortification will not be likely to ensue unless the main artery or nerve of an extremity has been severed, or the system at the time of the injury is in a bad condition. Punctured wounds of the scalp, hands, and feet are particularly prone to be followed by severe nervous and inflammatory symptoms, and also by erysipelas, the latter generally coming on within less than thirty hours after the infliction of the injury. When the lymphatic vessels become involved, as they often do, the disease is indicated by a red line extending from the seat of the injury towards the nearest lymphatic ganglions. A similar phenomenon, along with more or less induration, is witnessed when the veins participate in the mischief; an occurrence by no means uncommon.

The secondary effects of punctured wounds are often very serious, entailing much suffering, with occasional deformity and loss of limb, and demanding much care on the part of the practitioner. Needles, pins, fragments of glass, and pieces of bone sometimes enter the tendons, ligaments, and aponeuroses, and, causing severe and protracted irritation, ultimately lead to irremediable contraction.

The *treatment* of punctured wounds consists, first, in the extraction of the foreign body, in case it has not been already dislodged; secondly, in checking hemorrhage; and thirdly, in moderating inflammation and preventing the development of nervous symptoms.

To determine whether any extraneous matter remains in the wound, all that is necessary, in most cases, is simply to inspect the vulnerating body. If this exhibit marks of fracture, the probability is that a part

of it has been left behind; if so, the probe and finger will assist in detecting it. Should the wound, however, be very deep and narrow it may be necessary, before this can be done, to make an incision, the extent of which must depend upon the circumstances of each particular case, the only care to be observed being the avoidance of important structures, especially vessels, nerves, and tendons.

When a needle or other slender substance is embedded in the flesh, or buried in the cellular tissue, we may often succeed in detecting it by folding up the skin over it, or making gentle and systematic pressure with the ends of the forefingers at its supposed site, which is generally indicated, at least in recent cases, by a little puncture, perhaps not as large as a flea bite, upon the surface. Sometimes the local pain or tenderness affords valuable information as to the precise spot where the needle is lodged. I never hesitate, when there is reason to believe that the foreign body has been retained, to make, if necessary, a free incision for the purpose of extracting it; it is much better to do this at once than to temporize with the case, and to wait until bad symptoms arise, when such a procedure becomes inevitable, although it may now be too late to prevent altogether its bad effects.

In the sole of the foot pieces of bone, glass, and other small bodies are sometimes buried deeply beneath the plantar aponeurosis, where it is often quite impossible to detect their presence, however carefully searched for. I well remember a case of this kind which fell under my observation many years ago, in a most interesting boy, nine years old, who lost his life from this cause. As he was running about barefoot one morning, he trod upon a chicken bone, a fragment of which, nearly an inch long, entered the sole of the foot, lodging deeply in the substance of the flexor muscles, in contact with the metatarsal bones. Pain and swelling followed, but still the boy walked about for upwards of a fortnight, limpingly of course; the weather, in the meantime, being excessively hot. Suddenly symptoms of tetanus came on; Professor Willard Parker, then my colleague, and I now saw the case, and, although we made every effort to discover the foreign body, yet such was the swelling of the part and the depth at which it was situated that we could not detect it. Death followed in a few days, when we found it so completely buried that it required a very elaborate dissection to remove it.

The bleeding in punctured wounds generally ceases spontaneously; if a large artery has been laid open, or divided, it must be exposed, and tied at each extremity, in the usual manner. If this cannot be done, compression may be tried, as in the treatment of aneurism; or, this failing, or not being deemed admissible, the main trunk of the vessel is tied at some distance from the injury.

To prevent the occurrence of severe pain and nervous distress a full anodyne should always be given, if the case be at all severe, immediately after the accident, and the part wrapped up in flannels, wrung out of warm water and laudanum and frequently renewed. If the general health suffer, a dose of calomel should be administered, followed by oil or senna. If fever arise, the antimonial and saline mixture with morphia may be required, to act on the skin and bowels, and to allay pain

and induce sleep. If matter threaten to form, as indicated by the tension and throbbing of the part, free incisions must be made; erysipelas, angeioleucitis, and phlebitis must be treated in the usual manner. Nervous symptoms must be met with the liberal use of morphia and tartar emetic.

Along our Indian borders very severe wounds, of a punctured character, or partly of a punctured, and partly of an incised nature, are often inflicted with the *arrow*, which, as is well known, is capable of being projected, with extraordinary precision, to a great distance. Being usually made of the young willow, or other suitable wood, it varies in length from two feet to two feet and a half, and is feathered in the greater part of its extent, in order to facilitate its movements and increase its speed through the air. The head is generally furnished with a spear-shaped piece of flint, obsidian, or iron. This, which is technically termed the point of the weapon, is of a flattened conical figure, its length from base to apex ranging from three-quarters of an inch to an inch and a half; the corners, or angles, project in a line with the side of the free extremity, and are usually upwards of an inch in width, the whole arrangement being such as to enable the instrument to operate on the principle of the barb of a fish-hook. Thus constructed, the point is securely fixed in a notch on the head of the arrow by means of the tendinous shreds of the deer, coated over with the resin of the fir-tree.

It is supposed that many of our Indian tribes poison their arrows, so as to inflict a more deadly wound; but I am informed by an old pupil, Dr. William F. Edgar, of the U. S. Army, that this practice is peculiar to the savages inhabiting the mountainous regions watered by Pitt River, one of the northern branches of the Sacramento. These people, it is said, use the poison of the rattlesnake, by grinding the dried head of that reptile into an impalpable powder, which is then applied by means of the putrid blood and flesh of the dog to the point of the weapon, the wound of which proves speedily mortal.

Dr. T. C. Henry, of the U. S. Army, writes me that wounds made by arrows, often partake of the nature of incised wounds, or of those caused by the thrust of the small sword. The iron heads of these weapons are exceedingly thin, and being propelled with great force, make a clean cut, a portion of which not unfrequently unites by the first intention. Unless an important vessel is laid open, such wounds seldom bleed much. Sometimes the head of the arrow is broken off deep in the flesh, thus requiring a tedious dissection for its removal.

SECT. VI.—TOOTH WOUNDS.

Wounds inflicted by the bite of the human subject and of the inferior animals, as the dog, cat, or rat, partake of the nature of contused, lacerated, and punctured wounds. Such lesions are by no means uncommon, and from the danger which so often attends them, are worthy of more attention than they have hitherto received. I

have seen quite a number of cases of severe suffering occasioned by wounds received upon the fingers in the act of striking persons upon the mouth. The inflammation consequent upon such injuries is prone to assume an erysipelatous character, especially if, at the time of the accident, the constitution happened to be in a deranged state, and it is sometimes so violent as to be followed by mortification. In 1851, a distinguished jurist, struck a man upon the mouth, wounding his finger slightly against his teeth. Erysipelas promptly supervened, and the hand had to be amputated; subsequently the disease reappeared in the stump, and necessitated the removal of the arm.

The following cases will serve as illustrations of this class of injuries, of which I believe no account has yet appeared in any of our systematic treatises on surgery.

Mary Jackson, aged 47, always in good health, struck the back of her hand against the tooth of a servant girl, producing the merest scratch of the skin over the knuckle of the right index-finger; the part bled only a few drops, and caused hardly any pain at the time. Within two hours afterwards, however, it began to throb and ache, the pain extending up the hand, and thence gradually up the limb as far as the axilla, where considerable enlargement of the lymphatic ganglions soon took place. The forefinger swelled rapidly, and to an enormous degree; the hand and arm were also much tumefied, and a deep red line was seen passing along the limb. Great constitutional disturbance came on, attended with loss of sleep and appetite; and a large abscess formed in the theca of the finger, followed by necrosis of the last phalanx and anchylosis of the other joints. The whole limb remained for a long time sore, tender, and swollen, and upwards of a year elapsed before the re-establishment of the general health.

James Black, aged 36, farmer, eight weeks ago struck a man upon the mouth, receiving a superficial abrasion over the knuckle of the little finger of the right hand. Violent erysipelas of the whole limb followed; the finger became enormously swollen, and a large abscess formed in it, eventuating in the death of its phalanges. The general health suffered greatly, and a fresh attack of erysipelas broke out after the amputation of the finger. Many months elapsed before final recovery occurred.

A medical gentleman, upwards of seventy years of age, received a small wound upon the left index-finger by striking a negro lad upon the front teeth. Erysipelas soon showed itself, attended with exquisite pain, and extending up the limb beyond the elbow. After much suffering, in which the constitution seriously participated, the inflammation at length disappeared, leaving the finger stiff, crooked, withered, cold, and benumbed.

Thomas Clark, aged 47, farmer, in good health, struck a man on his mouth, on the 24th of December, 1851, the knuckle of the metacarpal bone of the right ring finger coming in contact with the incisor teeth; the skin was slightly broken, but he experienced no pain at the time. The same evening, however, the hand and finger became painful and stiff, and the next day they began to swell and to present an erysipelatous appearance. Excessive suffering ensued, producing profound

constitutional disturbance; and finally, in about three weeks, a large abscess formed in the hand, requiring the lancet. When I first saw the case, at the end of this time, the thumb and all the fingers were stiff and immovable; the wrist-joint was also much affected, and, in fact, the whole limb was sore and painful. In August, 1852, the thumb and fingers were still rigid and useless; much colder than natural, benumbed, and considerably attenuated. Every attempt to bend the fingers was attended with severe suffering. The right ring-finger was anchylosed at the metacarpo-phalangeal joint. There was still much uneasiness in the palm of the hand. The whole limb had an atrophied appearance.

The bite of the human subject is often followed by violent symptoms, coming on soon after the infliction of the injury. I have witnessed quite a number of such cases, and in several I have experienced much trouble in saving limb and life. I do not presume that the saliva has anything to do, in this class of wounds, with the production of the bad effects by which they are so liable to be succeeded; the parts are badly bruised, or bruised, lacerated, and punctured, and we well know how prone such injuries, however induced, always are to be followed by erysipelas and other serious consequences, especially when they occur in persons of intemperate habits, or disordered health.

The bite of the inferior animals, particularly when they are much enraged, is often succeeded by a very bad form of erysipelas. Many years ago I attended, along with Dr. Trimble, of Ohio, a child, about three years of age, who had been bitten in one of his fingers a short time previously by a rat. A severe attack of erysipelas soon came on, involving the whole hand and forearm, and causing the most violent local and constitutional suffering. The bitten part was converted into a large unhealthy ulcer, discharging a thin, sanious fluid, and was a long time in healing. Recovery finally took place, but not without permanent anchylosis of the finger, and partial atrophy of the hand and forearm. The bite of the dog, cat, and horse is liable to be followed by similar results. In India the slightest bite of the camel is said frequently to occasion severe inflammation and great general disturbance.

The treatment of tooth wounds and abrasions must be conducted upon the same general principles as ordinary contused and punctured wounds. I would strongly advise, however, that the part should always be well cleansed and bathed with warm salt water, to get rid of any saliva and other matter that may have been deposited by the teeth; after this the best application will be a lead and laudanum poultice, followed, if necessary, by leeches, and, if matter form, by early and free incisions. The dilute tincture of iodine, pencilled over the inflamed surface around the wound, will also be useful. The best internal remedies will be calomel and opium, with an active purge at the commencement of the treatment. When the case is obstinate, alteratives and tonics with change of air may be required.

SECT. VII.—GUNSHOT WOUNDS.

Gunshot wounds are injuries inflicted by fire-arms, as pistols, muskets, rifles, carbines, cannons, shells, and rockets; and are dangerous or otherwise according to their extent, the nature of the affected structures, and the state of the system at the time of their receipt. Occurring in all parts of the body, they may, in one case, be so slight as hardly to attract serious attention, while in another they may be so severe as to cause death upon the spot, either in consequence of shock or loss of blood, or, secondarily, from the violence of the resulting inflammation. Even when the person is so fortunate as to escape with his life, he often remains miserable ever afterwards on account of his mutilated condition, the repeated formation of abscesses, or the occurrence of neuralgic pains, which, hardly leaving him any respite from suffering, keep his mind and body in a state of constant irritation, and utterly incapacitate him for enjoyment and useful exertion.

The wounding missiles which are generally employed in civil life, in this country, are pistol, rifle, and musket balls, varying in their volume from that of a body but little larger than a swanshot to that of a small marble. Very desperate wounds are often inflicted with Colt's revolver. Until recently the ball in use in the American army was the round musket ball, which, with a view to greater efficiency, has been superseded by what is called the new rifle-musket ball, the weight of which is 500 grains. It is of a conical shape with a square hollow base; and when fired with a charge of sixty grains of powder, at a distance of 200 yards, penetrates eleven one inch pine planks, placed one inch and a half apart. At the distance of 1000 yards it penetrates three and one-fourth of such planks.

The British, French, and Russians employ a considerable variety of balls adapted to the peculiarities of their respective services. The Enfield ball, used by the English since 1853, is rapidly superseding all other missiles of that description. It is a long conical ball, hollow in the base, weighing ℥j and ℈ij. The French Minié ball weighs ℥j, ℥ij and ℈ij. The Russian ball, also conical, weighs ℥j and ℥vj.

It has been found in military operations that the conical ball, while it meets with much less resistance from the atmosphere than the round ball, passes to a much greater distance, and does more terrific execution upon entering the body, generally passing in a straight line, and fracturing and comminuting the bones in a most fearful manner; thus causing a much greater mortality, as well as a more frequent necessity for amputation.

The conical ball, moreover, is less liable to become flattened and divided than the round ball, and the aperture of exit is nearly always opposite to that of entrance, which was not so often the case formerly. It is alleged that much of the gravity of gunshot wounds in the Crimean war arose from the substitution of the conical bullet. To show with what power the Minié ball occasionally does its work, it may be stated that it has been known to pass through the bodies of two men and to lodge in that of a third standing some distance behind.

Sometimes two balls are united by a piece of lead, and put in a cartridge, thus producing, when fired, a terrible wound, as often happened in the Schleswig-Holstein war. The Russians in the Crimea also caused great mischief by this expedient.

Cannon balls are made of cast iron, and range in weight, on an average, from one to sixty-four pounds, the larger being chiefly used at sea and in beating down batteries, and the smaller in field-service. Grape-shot are small balls, confined in a canvas bag, arranged round a wooden spindle by means of a cord, the whole bearing a faint resemblance to a bunch of grapes, whence the name. From this the canister-shot differs principally in being contained in a cylindrical tin-case, closed at each extremity with a piece of wood. Both these classes of missiles are accurately fitted to the caliber of the guns from which they are intended to be discharged. "Shells are large hollow spheres of iron loaded with gunpowder, which may act either in their entire form as solid balls, or subsequently by the explosion of their contents, and their subdivision into numerous splinters, by which their ravages are greatly extended. Shrapnell shells, so named from their inventor, are hollow spheres, loaded partly with gunpowder, partly with balls."

Persons are occasionally killed with *wadding* discharged from an ordinary fowling-piece. An instance occurred, some years ago, in one of our theatres where a man lost his life from this cause in a sham-fight upon the stage. The wadding, which was a common cartridge, struck the side of the head, fracturing the temporal bone, and passing across the brain, lodged against the falx of the dura mater, from which it was extracted by Dr. John Rhea Barton after death, which happened in an hour after the accident. In 1838, a girl was killed in England by the discharge of a gun loaded with paper-pellets, some of which penetrated the body and lodged in the lungs and liver. In two other cases life was destroyed by a single pellet; in one, by laying open the fifth intercostal artery, and in the other by breaking the orbitar plate of the frontal bone, and injuring the brain. A case is recorded of a man being fatally wounded by a kid glove with a button attached to it; it was discharged from a blunderbuss, loaded with powder, and struck the person, who was standing ten feet off, upon his abdomen, in the cavity of which it was found on dissection.

It is well known that *gunpowder* alone, without any wadding, may, when discharged near the body from a gun, pistol, or fowling-piece, cause fatal injury. From the experiments of Lachèse it appears that, when the distance does not exceed six inches, and the weapon is large and strongly charged, the wound thus made will bear some resemblance to that produced by small shot, each particle which escapes combustion acting like a pellet. The fact that the mere explosion of powder near the body is capable of causing severe bruises, contusions, lacerations, and even death, has long been familiar to observers. The instances are quite numerous where great suffering, mutilation, and disfigurement are produced by the lodgement of grains of powder in the eyes, face, neck, and other parts of the body. Stone quarriers are particularly liable to such accidents.

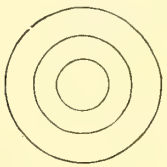
Small *shot*, striking the body in a concentrated form, are capable of

producing the same effect as a large bullet; if they are scattered, the injury will be less grave, unless they happen to hit an important organ, as the heart, brain, or spinal cord, when death may ensue in a few minutes, or, more remotely, from the resulting inflammation, as in several instances which have fallen under my own observation. Lachèse has ascertained by numerous experiments that a load of small shot discharged at a dead body, at a distance of ten inches, will make a clean round opening; at from twelve to eighteen inches the opening will be very irregular and ragged; whereas, at thirty-six inches, the shot will be scattered in such a manner as to enter separately, not making a common opening at all.

Grave injury is sometimes inflicted by the explosion of *percussion-caps*. Such accidents are sufficiently common among sportsmen, whose pleasures of the chase are often requited by the loss of an eye, and by the most excruciating suffering, from the lodgement of a piece of the foreign body in one of the chambers of that organ, or in the substance of the iris.

In its character, a gunshot wound partakes of the nature of a contused and lacerated wound; at the opening of entrance and for some distance around, the tissues are bruised, but as the ball passes onward it tears the parts, and at the opening of exit they often look as if they had been cut with a sharp knife. The effects of the transit of the missile upon the soft textures may be explained, as was first suggested by Sir Charles Bell, by a reference to a diagram consisting of three concentric rings. (Fig. 58.) The first, including the tubular wound, is bounded by tissues which are so compacted, condensed, or contused as to deprive them, to some extent, of their vitality, or, at any rate, to place them in such a condition as inevitably to lead to suppuration; consequently this portion of the wound seldom unites by the first intention. The structures between the first and second rings, having sustained less injury, will also inflame, but only, as a general rule, in such a manner as to give rise to a deposit of lymph, or lymph and pus; while those beyond the last circle will either retain their natural properties or, becoming excited, will merely experience some slight serous infiltration.

Fig. 58.



The above phenomena may generally be studied to the greatest advantage in deep flesh wounds, as those of the thigh. In such cases there is often a considerable slough of the bruised tissues, upon the separation of which the parts are seen to suppurate and to form granulations, while farther on they are hard, next œdematous, and beyond this natural. These phenomena, however, do not generally pervade the entire length of the wound; for it frequently happens that a considerable portion of the track unites by adhesive action, the tissues being lacerated instead of contused, as they are in the early stage of the passage, and consequently favorable to restoration. The precise point where the tubular wound loses the character of a contusion and assumes that of a laceration cannot generally be ascertained; it will of course vary very much in different cases, and under different circumstances.

The preceding remarks in regard to the injury inflicted by the projectile are chiefly applicable to the smaller kinds of balls, such as the pistol and rifle; the larger ones are generally productive of more serious mischief, and hence it often happens that the wound sloughs in its entire length, from the opening of entrance to that of exit; there being afterwards, when the dead parts have separated, extensive and tedious suppuration, the matter, perhaps, burrowing deeply among the soft structures, and thus greatly retarding the process of repair.

Disposition of the Projectile.—The manner in which the projectile is disposed of varies; sometimes it lodges, and then, of course, it makes but one opening; at other times it passes completely through the part, and so leaves two apertures, one of entrance, and the other of exit. Cases occur where one ball may make three, four, or even more holes. Thus, if it should happen to encounter a sharp edge of bone, as the crest of the tibia, it may be cut into two or more pieces, each of which may afterwards issue at a separate point. Dupuytren met with a case in which a ball, cut into fragments, made five orifices; and at Antwerp the younger Larrey saw six holes made in a similar manner. Again, a ball piercing the surface, just above the wrist, may be unable to penetrate the aponeurosis of the forearm, but, travelling along for some distance under the integument, may emerge below the elbow; then, the limb being considerably flexed at the moment, it may re-enter the skin a second time at the lower part of the arm, and finally escape near the shoulder-joint; thus leaving four apertures, two of entrance, and two of exit. Such an occurrence is, of course, quite rare; but its possibility should not be forgotten, as it is of great interest in a medico-legal point of view. A man, for example, might be shot in a duel, and his friends seeing the number of openings in the limb, might accuse his adversary of foul play, on the ground that he had used more than one ball.

When there is but one opening it is natural to conclude that the ball has lodged, and this, as already stated, is usually the fact. Instances, however, occur, although they are very rare, where the reverse is the case. Thus, a ball has been known to pass for some distance into the pectoral muscle, and to be immediately ejected by the recoil of a rib. The knee-joint has occasionally been opened, the ball being supposed to have lodged in the head of the tibia, but upon amputating the limb no ball was found, although there was but one opening. Lastly, a ball may enter the body, perhaps rather deeply, along with a piece of cloth, upon extracting which the missile may drop out. Instances, illustrative of the possibility of all these occurrences are circumstantially narrated in the admirable and instructive works of Percy, Guthrie, Hennen, Baudens, Macleod, and other military surgeons, and deserve an attentive perusal.

Large balls, fragments of shell, pieces of iron, and other substances, occasionally bury themselves deeply among the muscles, where they have been known to remain for a long time without exciting any suspicion of their presence. Larrey narrates a case in which he extracted a ball, weighing five pounds, from the thigh of a soldier, who had suffered so little inconvenience from it that it had been entirely over-

looked by the surgical attendant; and Hennen refers to a similar instance as having occurred at Seringapatam.

Considerable difference generally exists between the *openings* of entrance and exit. The former is usually rounded, with inverted edges, as if the skin had been slightly tucked in, and there is frequently more or less bluish or blackish discoloration of the adjacent surface, from the contact of burnt powder, deposited upon the ball at the moment of the explosion, and rubbed off as the ball strikes the body. When the discharge takes place within a few feet of the surface, scorched grains of powder often adhere to the skin, or may even be embedded in its substance. The opening of exit, on the contrary, has generally a slit-like appearance, looking rather as if it had been made with a sharp knife than an obtuse body; it is free from discoloration, and its edges, instead of being inverted, are turned out. I have met with cases where both openings had an incised appearance, but such a condition is rare.

A ball, flying in a straight line, under a strong impetus, will, on reaching the surface of the body, penetrate it in the same direction, dividing all before it in the cleanest and neatest manner, even to the bones, and probably issuing at a point directly opposite. If, on the other hand, its force is partially spent, then it will either not enter at all, or, if it do, it will be turned out of its course, the slightest resistance, as that offered by a tendon, ligament, or aponeurosis, serving to change its direction. The circumstances which tend to weaken the force of a ball are two, the attraction of the earth and the resistance of the atmosphere. It has been ascertained that a strong wind blowing perpendicularly to the direction of the American rifle-musket ball, will deflect it from its course 12 feet in 1000 yards, about one-fourth that distance in 500 yards, and about six inches in 200 yards. Besides, its impulse may receive a serious check by coming in contact with the person's accoutrement, or some article of dress, as a button, or breast-plate, or some substance that may happen at the time to be in his pocket, as a key, pencil, knife, or piece of coin. If, from these, or any other causes, the force of the projectile is partially spent, it may, on reaching the surface, either glance off; or, if it enter, it will be likely to be deflected; and the course which it sometimes pursues under such circumstances is most remarkable. Thus a ball has been known to pierce the forehead, but instead of penetrating the frontal bone, it has passed round the skull, underneath the scalp, and lodged upon the occiput, at a point nearly opposite to that of entrance; or, what is still more extraordinary, it has travelled nearly completely round the head, issuing only a short distance from the place where it struck. In the same manner a ball has been found to describe the circumference of the chest, its course being marked by a reddish weal or line. Several well authenticated cases are mentioned by writers on military surgery where the missile, piercing the wall of the chest by the side of the sternum, made the circuit of the thoracic cavity by passing between the costal and pulmonary pleuræ, and either falling down upon the diaphragm, or lodging in the wall of the chest behind, without inflicting the slightest injury upon the lung. Examples of a

similar kind occasionally occur in the abdomen, the ball, after entering the skin, being turned out of its direction by the tendon of the external oblique muscle, so as to pass round the belly beneath the integuments, and effect a lodgement near the spine, or, perhaps, escape somewhere upon the back. Finally, cases are not wanting, although they are certainly rare, where a ball has entered the abdomen in front, and issued behind, in a straight line, without wounding any of its contents. Such occurrences might challenge credibility, if the authors who have related them were not, from their high position and character for veracity, entitled to implicit confidence in their statements. They find their counterpart in sword, bayonet, and dagger wounds of the abdomen, in which the walls of that cavity are sometimes completely transfixed, and yet its contents escape unharmed.

Different tissues possess the faculty of deflecting balls in different degrees. Thus bone offers a greater amount of resistance than cartilage, cartilage than tendon, tendon than aponeurosis, and aponeurosis than muscle. Arteries, as already seen, often escape in a remarkable manner, their astonishing elasticity enabling them to glide away from the flying projectile. Common integument, too, readily throws a partially spent ball out of the straight line. Deflection of every description, however, is much less frequent now than formerly, owing to the substitution of the conical for the round ball, the former readily penetrating everything, even when fired at a great distance, whereas the latter is easily spent, and arrested on coming in contact with the more resisting tissues.

A ball, upon meeting a sharp bone, as the crest of the tibia, is sometimes cut in two as smoothly and evenly as if it had been divided with a knife. Some years ago I attended a gentleman, who, in a street rencontre, was wounded with a pistol, the ball striking the clavicle, which cut it into two nearly equal portions, one bounding off, and escaping, the other lodging in the lower part of the neck, from which I removed it several months afterwards. Cases have occurred in which, as before stated, bullets have been split into a number of pieces, each perhaps making a separate orifice in the skin.

The old round ball, in passing through the bones, often made a hole much larger than itself, especially when its force happened to be partially spent. Indeed, cases were occasionally observed in which the opening was so capacious as to admit, not only the ball, but also the barrel of the weapon from which it was discharged. The opening made by the conical ball is, on the contrary, comparatively much smaller; but, although this is the fact, the mischief which it inflicts is proportionably much greater, owing to the manner in which it breaks and comminutes the osseous tissue, the loose splinters themselves thus often becoming a source of severe injury to the soft parts.

Grave injury is sometimes inflicted upon a bone, even without the occurrence of fracture, simply from the violence of the shock which it experiences. The bullet strikes its surface with great force, bruising the periosteum, and causing dreadful concussion of the osseous tissue, but the force with which it is impelled is not sufficient to enable it to effect penetration. Erysipelatous inflammation is set up,

followed by exhausting suppuration, and, perhaps, sloughing and death.

Windage of Balls.—The older writers on military surgery had much to say respecting the windage of balls. It is well known that the most horrible injuries may be inflicted upon the body by cannon shot, completely pulpifying the muscles, lacerating the vessels and nerves, laying open large joints, and literally mashing the bones, and yet, perhaps, hardly bruise the skin, much less produce any serious wound. To account for these phenomena, various theories were invented, and it is not a little strange that the correct explanation of them should have been reserved for comparatively modern times. Even as late as the early part of the present century, several writers puzzled their minds to solve the much vexed question by a series of ingenious reasoning and argumentation worthy of a better cause. Thus we find that one gentleman has endeavored to account for the accident by supposing that the ball, as it passes by the body, powerfully condenses the atmosphere, thereby creating a vacuum, which is instantly succeeded by the forcible expansion of the part and its consequent laceration. The explanation was intended to apply more particularly to injuries of this kind as they occur in the hollow viscera, as the stomach and bowels. Another ingenious speculator has imagined that the effect is due to the action of the electric current generated by the rapid movement of the missile through the air. Finally, Mr. Spence, an English naval surgeon, informs us that the cause, at least on shipboard, where such accidents are not infrequent, is the violent contact of the wadding and other substances, as pieces of canvas and rope-yarn, which are so liable to be carried along with the ball. We may admire the ingenuity which prompted these views, but their fallacy is too apparent to admit of deception. The true cause of these injuries is the manner in which the projectile strikes the surface. It has been already seen that a ball in rapid motion will, on reaching the body, pass through it in a straight line; or that, instead of this, it will, if it be large, as in the case of a cannon-ball, carry away the part completely. But it is far different when the missile is projected lazily, or when, in consequence of the great distance over which it has travelled, its force is measurably exhausted. Under such circumstances, the slightest resistance will tend to deflect it, or change its course; it no longer passes in a straight line, but rolls or turns upon its axis after the manner of a billiard ball, and hence if, while in this condition, it strikes the body, it may inflict the most frightful injury both upon the muscles and bones, and yet not perhaps leave a trace of its effects upon the skin, the elasticity of which enables it to slide out of harm's way, while the other and deeper structures, which possess this property in a less degree or not at all, readily yield to its influence, and are severely injured in consequence.

That the older notions upon this subject are of a purely hypothetical character is shown by the fact that, during naval and military engagements, soldiers often have pieces of their dress, accoutrements, and even of their persons carried away by balls in rapid motion, without sustaining any serious injury in their bones and muscles.

The faculty possessed by the integuments of gliding out of the way of mischief is admirably exemplified in railroad accidents, which strongly resemble those inflicted by partially spent cannon balls, and in which they frequently escape in the most astonishing manner, while the deeper parts, soft as well as hard, are frightfully torn and pulpified. These gunshot lesions are much less frequent now than formerly, in consequence of the general introduction of the conical ball, which does its work more neatly and effectually, as well as at a much greater distance, than the old round ball, which, however, is still occasionally used.

Symptoms.—The symptoms of gunshot wounds necessarily resolve themselves into local and general, or into such as are peculiar to the part and system; and, it need hardly be added, vary greatly in their character, according to the extent of the lesion, the importance of the tissues involved, and the idiosyncrasy and other circumstances of the individual.

The *pain* consequent upon a wound of this kind is often quite insignificant, the person, although perhaps severely hurt, not being conscious of having received any injury until some minutes after it has been inflicted. In general, it is of a dead, heavy character, altogether different from that which attends an incised or punctured wound; it is only when a large nerve has been partially cut across that it is apt to be at all severe, and then it is usually very sharp, pricking, or burning. In this case, too, there will also be more or less numbness in the part below the wound, and sometimes, as when the principal nerve has been entirely severed, complete paralysis. Thus in gunshot wounds of the thigh, involving the division of the sciatic nerve, there is always loss of motion, and often, also, of sensation of the knee, leg, and foot, which feel as if they were cold and dead. The pain, however slight at the moment of the injury, is sure to be greatly aggravated upon the supervention of inflammation, so that the patient frequently requires large doses of anodynes for its suppression.

The *hemorrhage* in gunshot wounds is generally not at all in proportion to the severity of the injury, owing, as is commonly supposed, to the contused nature of the lesion. The structures immediately around the track of the ball are usually so much condensed that, unless the divided vessels are large, or numerous, the bleeding will, in the majority of instances, be so slight as to excite little, if any, alarm for the patient's safety. Very frequently, indeed, it amounts to the merest oozing, which soon ceases spontaneously, or under the application of cold water. If a large artery, however, happens to be laid open, the hemorrhage will not only be copious, but may be so great as to prove speedily fatal, perhaps in a few minutes at farthest, and, consequently, long before the surgeon will be able to interpose his skill for the preservation of life. Such an event will be more likely to occur if, as often happens in this class of injuries, the vessel is only partially divided, so as to prevent its retraction; here the blood will flow most freely, and, although it may be temporarily arrested by syncope, the clot will be washed away the moment reaction takes place, and thus the case will go on, the fainting recurring until the patient has bled

to death. If, on the other hand, the artery is completely divided, there may hardly be any hemorrhage whatever until the occurrence of reaction, or, perhaps, not even until the separation of the sloughs.

The ball often passes directly in the course of a large artery, perhaps the principal artery of a limb, and yet the vessel may completely escape injury, or, at most, be merely grazed by the missile. The reason of this is the resilient power of the vessel, which enables it to jump, as it were, out of the way of the projectile. Such an artery, however, will be particularly obnoxious to gangrene, and therefore to secondary hemorrhage during the separation of the sloughs.

The hemorrhage is generally external, the blood issuing at both orifices of the wound. The reverse, however, may be the case, especially if the injured parts have been thrown out of their relative position, or if, as sometimes happens, there has been extensive separation of the muscles; in such an event a large quantity of blood may be effused among the deep-seated structures, with hardly any outward bleeding. In wounds of the chest, abdomen, and pelvis, the hemorrhage is usually internal, and therefore the more dangerous, because concealed.

Gunshot wounds are, for the reasons already mentioned, extremely prone to *secondary hemorrhage*. A large artery may have been merely grazed, and, inflaming, a slough may form, which, separating, may give rise to severe, if not fatal bleeding in the space of a few minutes. Or an artery, of considerable size, may have been completely severed, but its ends, as well as the surrounding parts, having been violently contused a clot is instantly formed, which thus affords a temporary barrier to the escape of blood; by and by, however, reaction takes place, and then perhaps the artery is reopened, its contents now gushing out in a full stream; or the event may not take place for some days, perhaps not until after the establishment of suppuration or the occurrence of gangrene and sloughing. Sometimes the injured vessel is completely blocked up by the ball or other foreign substance, upon the removal of which copious hemorrhage ensues.

Secondary hemorrhage, the result of sloughing, usually occurs from the tenth to the fifteenth day; much, however, will depend, in this respect, upon the size of the ball and the amount of injury sustained by the soft parts around the wound, as well as by the vessel itself. In some instances it does not appear before the twentieth, twenty-fifth, or thirtieth day; and, on the other hand, it occasionally occurs as early as the fifth, sixth, or seventh day. However this may be, the patient should be most sedulously watched until he has safely passed the critical period.

The *constitutional symptoms* of the lesion are subject to much diversity. The shock is sometimes severe in a degree altogether disproportionate to the violence of the injury; the stoutest and most courageous individual will often swoon away from the most insignificant wound, and, on the other hand, a man may have his limb completely shattered, and yet not evince any serious alarm; his mind is perfectly calm and collected, and he is perhaps able to give the word

of command or cheer on his comrades up to the very moment of his dissolution. Temperament and idiosyncrasy have much to do in the production of these phenomena, and should have due weight in regard to our prognosis. It is said that veterans upon the field of battle generally, other things being equal, suffer much less apprehension and alarm from their injuries than new and inexperienced troops.

The subjoined case affords a good example of the manner in which shock occasionally causes death in gunshot wounds in civil life. For the particulars of it I am indebted to a former pupil, Dr. Colescott, who saw the patient instantly after the receipt of the injury.

A captain of the United States Army fell in 1851 in a duel near Louisville, the ball, which was very large, and was fired from a rifle at a distance of forty yards, entering the left thigh a little above its upper third, lacerating the soft parts in the most horrible manner, laying open the femoral vein, and crushing the bone into numberless fragments. The missile then passed into the right thigh, where it lodged, producing, however, but little mischief. Although hardly a pint of blood was lost, yet the system never rallied; the face continued deadly pale, the extremities cold, and the pulse small and feeble, notwithstanding the free use of brandy, up to the moment of the patient's death, which happened in two hours after the rencontre.

Prognosis.—The prognosis of gunshot wounds varies with so many circumstances as to admit of being pointed out only in a very general manner. Some of the milder cases of this class of injuries often recover promptly, without a solitary untoward symptom, the parts occasionally uniting, as I have myself seen in several instances, by the first intention. In other cases, on the contrary, apparently of a mild character, severe nervous symptoms may arise, or the wound may take on erysipelas, or a bad form of inflammation, and the patient lose his life. Two years ago, I attended, in this city, a young man who had been shot with a pistol, the ball, which was small, having entered the outer and back part of the arm, just above its middle, grazing the humerus, and lodging immediately under the integuments, from which I removed it an hour afterwards. The ordinary treatment was employed; but in thirty-six hours violent erysipelas set in, and death occurred in less than eight days from the time of the injury. On the other hand, seemingly the most desperate cases will sometimes recover. Much will of course depend, in every instance, upon the size and situation of the wound, the presence or absence of complications, the state of the patient's constitution, the condition of the atmosphere, and the nature of the treatment.

Some gunshot wounds must necessarily be fatal, either instantaneously, as when they involve one of the more important organs, or a large vessel, or more or less remotely, as a consequence of the resulting inflammation, gangrene, or profuse and exhausting discharge. The danger to limb, if not to life, will be great when a large joint has been laid open, the main artery, vein, or nerve severed, the bone crushed, or the integument extensively stripped off; or when all, or nearly all, of these parts suffer together. Gunshot wounds of the lower extremity are, other things being equal, more dangerous than those of the upper,

sharing, in this respect, the same fate as ordinary lacerated and contused wounds.

The presence or absence of complications will necessarily exert no little influence upon the issue of the case. Thus, a person, even if but slightly wounded, will often suffer most severely, and perhaps even die of the effects of his injury, if he was laboring at the time he was hurt under any serious disease of some internal organ, as the liver, lung, or bowel. The habits of the patient must also be taken into the account; if he is intemperate, his chances of recovery will be diminished, and so also if his constitution has been enervated by long residence in a warm, unhealthy climate; wounds inflicted in battle are generally more fatal than those received in civil life, especially if they are treated in crowded, ill-ventilated hospitals. Under such circumstances death often occurs from sheer neglect, or the want of good nursing and suitable surgical treatment.

The causes of death in gunshot wounds are, first, shock and hemorrhage; secondly, tetanus; thirdly, pyemia and erysipelas; fourthly, gangrene; and fifthly, profuse suppuration and hectic irritation.

Remote Effects.—The remote effects of gunshot wounds are often very troublesome, entailing much suffering, and being occasionally followed by loss of life at the distance of many years. In a case of gunshot wound of the chest, related by Dr. M. H. Houston, of Wheeling, Virginia, a thick linen patch, with which the ball had been enveloped, remained in the left lung for twenty years, when the patient died in a state of extreme marasmus, his general health never having been good since the occurrence of the accident. Sometimes a bullet lodges in the head of a bone, where, although it may for a while be comparatively harmless, it ultimately causes necrosis, with inflammation and discharge in the soft parts, thus necessitating the removal of both substances, if not of the limb itself. It is related of Marshal Moncey that he died from the effects of a gunshot wound forty years after its receipt.

On the other hand, however, a ball may occasionally remain in the body for a long time—perhaps in an organ even of vital importance—without inducing any particular mischief. Thus, in a case recently reported by Dr. Henry Wurtz, of New York, an ounce bullet was found, on dissection, in the middle lobe of the right lung of an old soldier, forty-five years after its introduction at the siege of Badajoz. It was inclosed in a distinct cyst, an inch below the surface of the organ, having entered between the fourth and fifth ribs, as was proved by the existence there of an old cicatrice.

Treatment.—In the treatment of gunshot wounds five distinct indications are presented: 1st. To revive the patient, or promote reaction; 2dly. To arrest hemorrhage; 3dly. To extract the ball and any other foreign matter that may have entered along with it; 4thly. To remove any detached or loose pieces of bone; and 5thly. To circumscribe the resulting inflammation.

1st. The first indication is to relieve *shock*, which is to be fulfilled by the employment of the ordinary restoratives. If the patient be faint, he must be placed at once in the recumbent posture, with his head as

low as the rest of the body; cold water must be dashed upon the face. the fan be freely used, and smelling bottles held near the nose. If the symptoms are urgent, sinapisms are applied to the chest, spine, and extremities, a stimulating injection is thrown into the bowel, and, if the power of deglutition is not gone, brandy or wine and ammonia are given by the mouth. If there be internal hemorrhage, however, care is taken to bring up the pulse slowly and gently, allowing time for the formation of coagula, and guarding against the occurrence of violent inflammation. A kind look, or a soothing expression will often do more to revive the patient and encourage recovery than anything else.

2dly. If the *hemorrhage* be capillary, or caused by the division of very small vessels, it will probably cease of its own accord, or simply by exposure of the part to the cold air, or under the application of cold water, pounded ice, or some astringent lotion. If it be venous, compression will probably suffice; but if it proceed from a large artery, such as the radial or tibial, nothing short of the ligature will do, and no time should be lost in its application. The case is very simple when the vessel is superficial, and the wound capacious; but under opposite circumstances the duty of the surgeon is often exceedingly embarrassing. Here it becomes necessary either to dilate the wound, so as to expose the artery and tie it at both ends, which is by far the best plan; or, where this is impracticable on account of the depth of the vessel, its proximity to important structures, or the great swelling and infiltration of the parts, as may happen when some time has elapsed since the receipt of the injury, to cut down upon the main trunk of the vessel, and to secure it as in the Hunterian operation for aneurism. The latter procedure, however, will rarely succeed, inasmuch as the bleeding is extremely liable to be kept up by the recurrent circulation; hence it is always best, if practicable, to cut down at once upon the injured artery, and to apply a ligature to each extremity, which cannot fail to put an effectual stop to the flow of blood. The more promptly the operation is performed the better; if the surgeon wait till inflammation has supervened he will experience great difficulty, not only in exposing the artery, but also in inducing the ligature to maintain its hold upon its softened and partially disorganized tissues. When the hemorrhage has been very profuse, but has gradually or suddenly stopped, it will hardly be safe to intrust the case to the efforts of nature, because, when reaction occurs, the vessel will almost be sure to be reopened, and thus the bleeding may progress until the system is completely exhausted; but if the surgeon has done his duty, the parts will be placed in the best possible condition for speedy recovery. It is a good rule, in such cases, to do whatever may be necessary without the slightest temporizing.

3dly. The third indication is the *extraction* of the ball; but to do this it is necessary, in the first place, to ascertain where it is; to grope about in the wound without any definite ideas as to its precise location, would only be to inflict additional pain and injury. In order to conduct the examination with the greatest advantage, the part should be put as nearly as possible in the position in which it was at the time of

the accident. This is the more necessary, because, as was before stated, the missile often pursues a very different route from what might be supposed from merely looking at the orifice of entrance or exit; the slightest resistance may change its direction, and compel it to lodge at a situation far beyond what it would have sought had it been permitted to pass in a straight line. Hence attention to the position of the part becomes, in all cases, a matter of paramount importance.

The best *probe* for conducting the examination is the finger, provided it is sufficiently long and slender; it possesses the same value, in such cases, as direct auscultation possesses in the exploration of the chest, or the finger in the examination of the uterus and rectum, and should therefore always be used when practicable. If the digit be inadequate, recourse is had to a stout probe (fig. 59), at least from ten to twelve inches in length, as thick as a medium-sized bougie, slightly flexible, and blunt-pointed, being composed either of silver or brass. The ordinary pocket probe is much too small. When such an instrument as that just described is not at hand, the necessary exploration may be performed with a female sound or catheter, or even with a long, slender pair of bullet-forceps. Whatever instrument is employed, it should be passed along the track of the wound with all possible care and gentleness, and in such a manner as not to insinuate its point into the surrounding cellular tissue, or among the muscles, tendons, nerves, and vessels; a circumstance which may very easily happen if the surgeon do not observe the utmost caution in performing the operation. The contact of the probe with the ball usually produces a sensation of roughness and resistance, together with a dull noise if the instrument be struck against the foreign body by short jerks. The parts being now accurately maintained in the position in which the ball was found, the forceps take the place of the probe, the blades being firmly closed as they pass along the track until the point comes in contact with the extraneous substance, which is then seized and extracted, care being taken to include none of the surrounding tissues. Occasionally the operator will derive important aid in his manipulations from counter-pressure, the hand or the thumb and a few fingers being applied to the opposite side of the wounded parts.

Fig. 59.

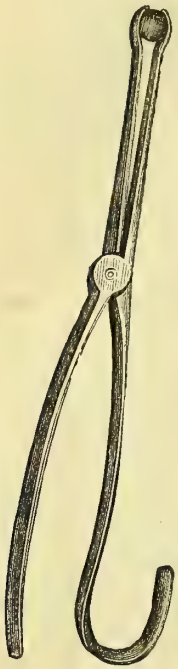


Various forms of *bullet-forceps* are in use, very few of which possess any real advantage over each other; their most important qualities are lightness, strength, and slenderness, with length of blade, which should not be less than four inches. The extremity is well rounded off, and the inner surface of each blade is provided with a cup-shaped depression, the margin of which is serrated for the more easy and firm retention of the foreign body.

The annexed drawing (fig. 60), conveys a good idea of the size and shape of this class of instruments. The ball is grasped by the blades.

When the wound is unusually large, and the ball not deeply seated, the extraction may sometimes be effected with a small lithotomy scoop, the common dressing forceps, or with an instrument like that sketched in the adjoining cut (fig. 61), and which was made for me by Mr. Kolbé, a distinguished cutler of this city. It consists of a silver tube, inclosing a steel stylet, terminating in two blades, cup-shaped on the inside, and movable by a hinge. The extremity of the instrument, is represented as grasping the ball. The other wood-cut (fig. 62), illustrates an instrument of similar construc-

Fig. 60.



Bullet-forceps; in the act of removing the foreign body.

Fig. 61.

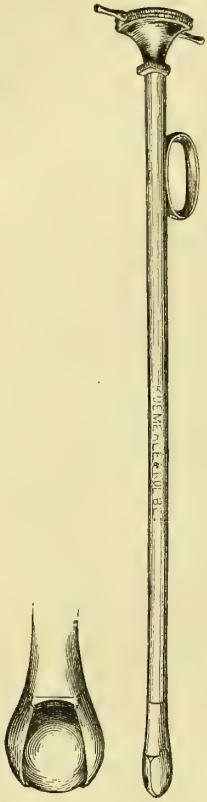
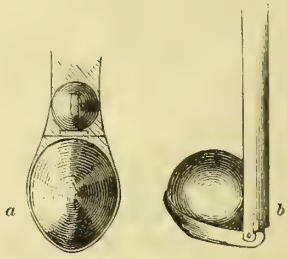


Fig. 62.



Kolbé's bullet extractors.

tion, only that the stylet consists of a single blade; *a* shows the cup-shaped appearance of the extremity, which, at *b*, is expanded over the ball, holding it with great firmness. The gimlet-like instrument, so much extolled by the older surgeons, is now rarely used, although it might still occasionally be employed with advantage when the extraneous substance is lodged in a bone thickly covered by muscles. The trephine, however, is generally preferred under this and other similar circumstances.

A ball, after having traversed the thickness of a limb, or of the body, occasionally lodges immediately beneath, or among the superficial muscles, where its presence is readily detected by the probe or finger. In such a case the best plan is to remove it by a *counter-opening*, that is, by cutting down upon it at the nearest point; a procedure which often saves an immense amount of pain and trouble.

When the ball cannot be found without much probing and the risk

of inflicting serious additional mischief, reason and experience alike suggest the propriety of letting it remain, in the hope that it may either become encysted, or that it will be detached and washed away by the discharges. In general, however, every justifiable effort should be made to remove it, on the ground that, if left behind, it will be almost sure to excite violent inflammation, followed by profuse suppuration and extensive separation of the tissues. Such an event will be the more likely to happen if the ball has become rough, jagged, or flattened by contact with a bone; for then it never can be encysted, but must necessarily keep up irritation as long as it remains.

The great importance of not permitting balls to remain unextracted has been placed in a forcible light by the observations of Mons. Hutin, chief surgeon of the Hôtel des Invalides of Paris. Of 4,000 soldiers examined by this distinguished practitioner, within a space of five years, only 12 presented themselves who had experienced no inconvenience from the retention of foreign bodies, while the remainder, 200 in number, had all suffered more or less severely until they had been relieved by operation.

Another reason for the early extraction of these missiles is that persons soon after the receipt of their injuries will, in general, submit much more readily to the necessary operation than they will after they have partially recovered from their effects; their dread usually increasing in proportion as they get well, and beyond the reach of immediate danger.

When a ball has entered a movable joint, it should always be promptly extracted if it lie loose within its cavity; if, on the other hand, it has lodged in the adjoining bone, it should be allowed to remain, in the hope that it may soon be covered over with plastic matter, and thus become comparatively harmless. The only exception to this rule is where the ball projects into the cavity of the articulation, in which case it should be removed at all hazard, since its retention would inevitably lead to violent, if not fatal, inflammation, and utter uselessness of the part.

No sensible surgeon ever thinks of searching for a ball in any of the great cavities of the body; such a procedure would be sure to increase the dangers of the accident, and cannot, therefore, be too pointedly condemned.

If it be necessary to the welfare of the part and system to remove a ball, which is a comparatively innocuous substance, how much more important is it to extract the various *foreign bodies* which so often enter along with it, and the presence of which is an incessant source of irritation and annoyance, however protected it may be. The rule here is imperative, and applies to the smallest, as well as to the largest substance; to the little piece of wadding and the stoutest splinter, the linen shred and the brass button; in short, to all extraneous matter whatever. Wherever it may be, it must be sought for, and, if possible, extracted without delay. There is no chance here of the formation of a cyst, as sometimes happens with a ball; nature admits of no such liberty. In naval and military engagements large pieces of wood, metal, and other substances are liable to be impelled into the

body, in which they are often buried at a great depth, or lodged among the muscles, which sometimes close over them in a sort of a valve-like manner, rendering it extremely difficult not merely to extract but even to find them. Much may be done in such cases by the gentle use of the finger and probe, aided by counter-pressure.

4thly. Any detached *splinters* of bone, or pieces of bone so much loosened as to render it improbable that, if left behind, they will become reunited, should be removed as early as possible after the occurrence of the accident, experience having shown that their retention is always productive of extensive and protracted suppuration, if not of worse results. By the timely extraction of such bodies immense suffering may be prevented, and ultimate recovery vastly expedited. It is surprising that surgeons should ever hesitate in such a case; and yet the instances are not uncommon where the most culpable neglect is observed. A remarkable example of the kind fell under my notice in 1847, in the person of Lieut. George Adams, of the United States Marine Corps, who was desperately wounded in the right thigh by a large musket ball during our war with Mexico, at the battle of the National Bridge, between Vera Cruz and Jalapa. The soft parts were extensively injured and the bone was shattered into numerous fragments, not less than twenty-four of which, some of them upwards of an inch and a half in length, I removed nine months afterwards, from the enormous callus that had formed around the seat of the fracture; most of them were completely imprisoned in the osseous matter, and it was therefore found quite difficult to extract them. The incisions healed kindly, except at one point, which refused to close, and from which a small fragment of bone was subsequently removed by the late Professor Warren, of Boston.

When *powder* is embedded in the skin, the first thing to be done is to pick out, with a cataract needle, or delicate bistoury, every particle of it, regardless of pain. If this be neglected the powder will speedily excite inflammation, besides causing disagreeable and permanent disfigurement by the bluish spots which it leaves. The operation is tedious, and is always attended with severe suffering. The resulting inflammation is to be combated in the usual manner; cold water, or cold saturnine lotions, being generally the best local remedies.

5thly. The fifth and last indication is to circumscribe and moderate the resulting *inflammation*. To accomplish this, attention to various points is necessary. In the first place, the parts must be properly dressed. Works on surgery generally direct that the orifices of the wound shall be lightly covered with lint and adhesive plaster. Is such a procedure rational? It certainly is not, for its direct effect must inevitably be to prevent discharge, of which there must always be more or less in every such case, and consequently to aggravate the local mischief. A much better plan is to allow the orifices to remain open, while we attempt, by means of a light compress and bandage, to close its sides, with a view of facilitating their union by adhesive action. The roller should be carried up from the distal part of the limb to some distance beyond the wound, care being taken to perforate it opposite its orifices, in order to admit of free drainage.

In this manner nature may often be immensely assisted in the cure; the inflammation will generally be moderate, infiltration of fluids will be obviated, and the patient will frequently recover in a surprisingly short period, and with but little suffering. The bandage, however, must be used with great caution, for there is danger, especially if there be much swelling, of its producing injurious compression, and thus becoming a source of gangrene. My experience in the treatment of gunshot wounds is necessarily limited, but it is sufficient to justify me in asserting that adhesive plaster should, as a general rule, be dispensed with; it is certainly not easy to perceive how it is possible for it to do any good.

The part having been dressed, and placed at rest in an easy and elevated position, the next thing to be done is to apply cold water, provided there is no contra-indication to its use, growing out of the state of the weather, or the intolerance of the part and system. If the weather be mild, and the patient young and robust, cold will usually be borne better than warmth, and the most eligible form is that of water, either simple, or medicated with opium and acetate of lead. The use of cold water in the treatment of this class of lesions dates as far back as the time of Blondius, towards the middle of the sixteenth century, and its beneficial effects, although lost sight of for a long time, were again brought prominently before the notice of the profession by Kern, Larrey, Guthrie, and other army surgeons, during the continental wars which deluged Europe early in the present century. Cold water, however, is not tolerated equally well by all patients, and hence the rule is, where it disagrees, to substitute warm applications, either in the form simply of tepid water, or in that of a light emollient cataplasm, which, after all, makes, in many cases, an admirable dressing, soothing pain, and promoting discharge.

If the inflammation assumes a threatening aspect, and especially if it becomes erysipelatous, and is attended with great pain, tension, and swelling, free incisions, and sometimes counter-openings must be made, otherwise extensive mischief will result from the burrowing of fluids, and the consequent destruction of the connective tissues. Besides, the parts, if not timeously relieved, might mortify. The older surgeons made it a rule of practice to dilate all wounds of this kind as soon as possible after their infliction, with a view of preventing these and other untoward results, but this procedure has become obsolete, the modern practitioner resorting to it only when the necessity arises in consequence of the severity of the inflammation; assuming that a man ought not to be cut merely because he has been shot.

Conjoined with these local measures must be perfect rest of mind and body, along with light diet, mild purgatives, and anodynes, for the double purpose of allaying pain and spasm, and inducing sleep. Opiates will generally be borne in large doses, and can rarely be dispensed with in any case, however mild. If the wound is severe, and especially if it be attended with serious hemorrhage, active purgation must be scrupulously abstained from, as must also be antimonials, on account of their depressing effects, and their tendency to provoke tetanus. In all cases due allowance must be made, in our treatment,

for the drainage which is likely to attend such injuries. Hence much judgment is often required to steer clear of difficulty and danger. Bleeding by the lancet is hardly to be thought of under any circumstances; in young and plethoric subjects, however, blood may occasionally be taken advantageously by leeches. If decided exhaustion be present, whether from shock, loss of blood, or inflammatory disturbance, prompt recourse must be had to milk punch, quinine, and nutritious diet.

QUESTION OF AMPUTATION IN WOUNDS.

The most horrible wounds are generally those which are inflicted by machinery in rapid motion, the passage of a railway car, or the wheel of a heavy wagon, and the explosion of fire-arms, violently lacerating and contusing the soft parts, extensively crushing the bones, and perhaps opening one or more of the larger joints. In many cases, the character and extent of the mischief are apparent at first sight; in others, as when it is principally subcutaneous, it becomes so only after a most patient and thorough examination. The latter class of injuries is particularly to be dreaded, as it is often impossible, even with the greatest care, to determine the extent of the lesion. When the examination necessary to ascertain the condition of the parts is likely to be painful or protracted, commiseration for the sufferer always dictates the propriety of administering chloroform, although the effect of the anæsthesia will rarely be required to be carried to the extent of complete unconsciousness, a few full and prolonged whiffs being generally sufficient to effect the desired tolerance.

In trying to determine the question as to whether an attempt should be made to cut off or save a limb, not a little stress should be laid upon the age, habits, and previous health of the patient, the manner in which the injury was inflicted, and the number, variety, and importance of the structures involved.

Young adults bear severe accidents much better, other things being equal, than the two extremes of life, childhood and decrepitude, in both of which, but especially the latter, the power of reaction is generally very feeble, and the effect of shock and hemorrhage felt for a long time. Nevertheless, there is not a practitioner of any experience that has not occasionally witnessed striking exceptions even under these circumstances. A temperate man usually bears up under a severe wound much better than a dissipated one, and the resident of the country than the inhabitant of the crowded city; a person in ill health at the time of the accident will be likely to suffer more than one in an opposite condition. The worst class of accidents in civil practice are those inflicted by railway cars, steamboats, and steam factories, and these are often of such a nature as to require the prompt removal of the mangled and mutilated parts.

But of all the circumstances influencing the recovery of the patient, and the ability of the surgeon to save the mutilated parts, the most important, by far, is the extent of the injury, or the number and nature

of the tissues involved. To place this subject in a clear and tangible light, it is requisite to consider it somewhat in detail. Before doing this, however, it is proper to premise that amputation should never be performed in wounds of any kind until after reaction has taken place; as, if this precaution be neglected, the additional shock which the operation would necessarily impart to the system might prove fatal, either before the patient is removed from the table, or soon after. As long as he is deadly pale, the pulse small and thready, the surface cold, and the thirst, restlessness, and jactitation excessive, it is obvious that recourse to the knife must be wholly out of the question. The proper treatment is recumbency, with mild stimulants, sinapisms to the extremities, and other means calculated to re-excite the action of the heart and brain. Power being restored, the operation, if deemed necessary, is proceeded with, due regard being had to the prevention of shock and hemorrhage, the two things now mainly to be dreaded.

The following circumstances may be enumerated as justifying, if not imperatively demanding, amputation in cases of wounds, whatever may be their nature:—

1st. When a limb has been run over by a railroad car, fracturing the bones, and tearing open the soft parts, amputation should, as a general rule, be performed, even when the injury done to the skin and vessels is apparently very slight, experience having shown that such accidents seldom do well, if an attempt is made to save the limb, the patient soon dying of gangrene, pyemia, or typhoid irritation. The danger of an unfavorable termination in such a case is always greater when the lesion affects the lower extremity than when it involves the superior.

2d. No attempt should be made to save a limb when, in addition to serious injury done to the integuments, muscles, or bones, its principal artery, vein, or nerve has been extensively lacerated, or violently contused, as the result will be likely to be gangrene, followed by death.

3d. A lacerated or gunshot wound penetrating a large joint, as that of the knee or ankle, and accompanied by comminuted fracture, or extensive laceration of the ligaments of the articulation, will, if left to itself, be very prone to terminate in mortification, and is therefore a proper case for early amputation.

4th. Gunshot wounds attended with severe comminution of the bones, the fragments being sent widely around among the soft parts, lacerating and bruising them severely, generally require amputation, especially in naval and military practice.

5th. Extensive laceration, contusion, and stripping off of the integuments, conjoined with fracture, dislocation, or compression and pulpification of the muscles, will, in general, be a proper cause for the removal of a limb.

Should amputation be performed when a limb, the subject of a severe wound, laceration, or contusion, has been suddenly seized with mortification, manifesting a rapidly spreading tendency, extending, perhaps in a few hours, up as far as the middle of the leg, or even as high as the knee? In general, such cases are desperate; no local or internal remedies can arrest the morbid action; the system has sus-

tained a profound shock, and the affected parts perish, not by inches, but literally by feet. I have repeatedly seen this variety of gangrene extend from the toes, instep, or ankle as far as the hip-joint in less than thirty-six hours, and that, too, in cases where there was but little visible injury, the mischief being evidently deep-seated, involving muscle, nerve, vessel, and bone. If amputation be not performed, the disease, whose march is indicated by a bluish or livid, crepitating, and tender streak along the limb, will be sure to terminate fatally in a few days, and the operation should therefore, in my judgment, be resorted to at the earliest possible moment, the surgeon not foolishly waiting for a line of demarcation, which cannot take place, since neither part nor system has the power of arresting the morbid action. The event, it is true, will generally be unfavorable, but as it is the only chance the patient has, he should, slender though it be, certainly have the benefit of it. In the few cases in which I have amputated under these unpropitious circumstances, the result in all has been fatal.

Lacerated, contused, and gunshot wounds are often of so frightful a nature as to render it perfectly certain, even at a glance, that the limb will be obliged to be sacrificed in order that a better chance may be afforded for preserving the patient's life. At other times, the injury, although severe, may yet, apparently, not be so desperate as to preclude, in the opinion of the practitioner, the possibility of saving the parts, or, at all events, the propriety of making an attempt to that effect. The cases which may reasonably require and those which may not require interference with the knife are not always so clearly and distinctly defined as not to give rise, in very many instances, to the most serious and unpleasant apprehension, lest we should be guilty, on the one hand, of the sin of commission, and, on the other, of that of omission; or, in other, and more comprehensive terms, that, while the surgeon endeavors to avoid Scylla, he may not unwittingly run into Charybdis, mutilating a limb that might have been saved, and endangering life by the retention of one that should have been promptly amputated. It is not every man, however large his skill and experience, that is always able to satisfy himself, even after the most profound deliberation, what line of conduct should be pursued in these trying circumstances; hence the safest plan for him generally is to procure the best counsel that the emergencies of the case may admit of. But in doing this, he must be careful to guard against procrastination; the case must be met promptly and courageously; delay even of a few hours may be fatal, or, at all events, place limb and life in imminent jeopardy. Above all, let proper caution be used if the patient is obliged to be transported to some hospital, or to a distant home, that he may not be subjected to unnecessary pain, exposed to loss of blood, or carried in a position incompatible with his exhausted condition. Vast injury is often done in this way, by ignorant persons having charge of the case, and occasionally even by practitioners whose education and common sense should be a sufficient guarantee against such conduct. The transportation of a patient to a distance of perhaps a hundred or a hundred and fifty miles upon a railway car, after he has been desperately wounded, in the hope, it may be, of obtaining

better aid, cannot be too severely reprehended, as involving not only the loss of precious time, but often also the infliction of additional injury upon a part and system already overwhelmed by shock and hemorrhage.

Further observations upon this subject will appear in the chapter on amputation, and in those on fractures and dislocations.

SECONDARY EFFECTS OF WOUNDS AND CONTUSIONS.

Every practitioner occasionally meets with cases of wounds and bruises in which the patient, happily escaping from the primary effects of the injury, suffers severely from what may be termed the secondary effects, coming on several weeks or months afterwards. These lesions have not received sufficient attention from systematic writers. It has fallen to my lot to see quite a number of such cases, and I select the following from my note-book in illustration of the subject:—

A farmer, aged thirty, in August, 1851, got his left foot twisted and bruised by a fall from his horse. The accident was instantly followed by severe pain, and next day by excessive swelling, which, however, gradually subsided under the usual antiphlogistic remedies. In the course of a few weeks the man was able to exercise on crutches, but the foot was now observed to be very sore and tender, cold, clammy, withered and benumbed, and to be completely destitute of power. There was also frequent twitching of the three small toes, particularly at night, so as to interfere with sleep. These symptoms were aggravated in damp, cold states of the atmosphere, when there were also occasionally neuralgic pains in the part. The general health likewise materially suffered, the appetite being bad, the bowels irregular, and the mind much dejected. When I saw the patient, nearly a year after the accident, he had been subjected to various plans of treatment, with hardly even any temporary relief. I placed him upon tonics and alterants, and ordered the hot and cold douche, with frictions with veratria liniment and the use of the bandage; but many months elapsed before he experienced much benefit from the treatment, and I believe he has never entirely recovered the use of his foot and ankle.

A man, aged 25, cut himself, in October, 1852, with an axe on the instep of the left foot, directly over the internal cuneiform bone. The weapon penetrated the bone, and evidently severed the extensor tendon of the great toe, as the toe could no longer be moved by the effort of the will. The wound healed completely in a few days, but in a short time afterwards the parts became tender and remained so for several months. Meanwhile, the foot and leg grew sensibly thinner, and were habitually cold and clammy; a state of things which has now continued for several years. Whenever exercise is taken, the parts swell, and become tender. The muscles of the whole limb are flabby and wasted. The general health is much disordered; the man has lost thirty pounds of flesh, and has been unable to attend to any

business since the accident. His tongue is habitually coated, he sleeps badly at night, and he is subject to frequent fits of despondency.

A man, aged 35, consulted me in March, 1854, on account of an accident similar to the above. He was a bricklayer by occupation, and previously was always in good health up to October, when he cut himself with a hatchet in the left instep, immediately over the internal cuneiform bone, as nearly as possible in the same situation as in the preceding case. The wound healed rapidly, but the man soon began to suffer with exquisite pain and tenderness in the parts, extending up the leg, and subject to severe exacerbation from damp states of the atmosphere, exposure to cold, and derangement of the digestive organs. The suffering was not regular in its recurrence, but it was generally worse at night, and often sadly interrupted his sleep. The limb was cold and clammy, as well as much emaciated, and the parts immediately around the scar were hard, as if from the presence of organized lymph. The general health was much impaired, the tongue was coated, and the sleep was usually much interrupted by spasm of the limb. A prominent symptom in the case was great soreness in the hollow of the foot, in front of the heel. When the man attempted to walk, the foot became very tender, and began immediately to swell. Both in this and in the preceding case the patient was obliged to use crutches.

A lady, aged 27, the wife of a medical gentleman, in February, 1852, punctured the forepart of her right wrist, towards the ulnar margin of the forearm, with a small slender sewing needle, which entered the skin directly over the ulnar artery, and passed, apparently, obliquely inwards and outwards towards the centre of the joint, without, however, penetrating it. The needle was immediately withdrawn, but not examined, and the patient, consequently, was uncertain whether a portion had broken off and remained behind. The accident was followed by the most excruciating pain, pervading the entire extremity from one end to the other, but being particularly severe at the seat of the injury and in the thumb and first two fingers. A violent rigor soon followed, and for ten days the woman suffered the most horrible tortures, being frequently threatened with tetanus, and constantly annoyed with spasmodic twitches of the muscles of the hand and arm. Considerable swelling arose soon after the receipt of the injury in the forearm, wrist, hand, thumb, and the fingers above named. About the end of the tenth day a small circumscribed abscess formed at the site of the puncture, which, upon being lanced, discharged about a drachm and a half of thick pus, much to the relief of the patient. In a week the matter had reaccumulated, and the part was again lanced, followed by the same relief as before. Subsequently the skin was scarified several times, the cuts bleeding profusely at each operation, but not yielding any pus.

During the following summer the patient experienced severe and constant pain, especially in the anterior part of the arm, between the elbow and the insertion of the deltoid muscle; it was always more violent in the evening, and was of a dead, heavy aching character; the limb was stiff and numb.

When I first saw the patient, in November, 1852, she informed me

that her general health had been very bad for the last six years, that she was subject to dyspepsia, and that she was naturally of a nervous, excitable temperament. She had formerly suffered, at intervals, from rheumatism. For the last four months she had had a seton in the upper and forepart of the arm, on account of the severity of her pain, which, however, at this time, was much less than formerly. She thought she had derived much benefit from the seton. Her hand and thumb, together with the fore and middle fingers, swelled every evening, becoming stiff and sore, so that she could with difficulty flex or extend them. In the day the parts felt much more comfortable. The pain and soreness were always greatest at night. Pressure at the seat of the puncture gave rise to uneasiness rather than to pain, but was always followed soon after by so much distress as to prevent sleep during the succeeding night. The ring and little fingers were natural, free from swelling, and easily moved. The whole limb was cold and considerably wasted.

The probability is that, in this case, the needle pricked the ulnar nerve at the wrist, producing a condition of things, in her bad state of health, similar to that which occasionally results from the puncture of a nerve in bleeding at the arm.

Under the use of an alterative and tonic course of treatment, with strychnine and arsenious acid; the hot and cold douche, followed by friction with veratria ointment; a nutritious diet and exercise in the open air; the general health rapidly improved, and the local suffering finally disappeared, though the limb has never recovered its original powers.

Bad effects not unfrequently follow upon gunshot wounds; they present themselves in different forms and degrees, and often entail great suffering along with partial loss of function. Among the more common and annoying of these secondary effects are neuralgic pains and a sense of numbness in the parts, progressive atrophy of the muscles, contraction of the aponeuroses and tendons, and anchylosis of the joints.

In regard to the treatment of these secondary lesions, it is impossible to lay down any definite plan of action; every case must be managed according to the peculiarities of its symptoms. Much benefit may generally be expected from attention to the state of the general health, which is nearly always more or less seriously disordered. Neuralgic pains, altered sensibility, and atrophy usually require a course of tonics and arsenic, purgatives, the hot and cold douche, and dry frictions. Rigidity of the joints must be counteracted by passive motion and sorbefacients, and contraction of the tendons and aponeuroses by the use of splints and the bandage.

MAGGOTS IN WOUNDS.

The development of maggots in wounds and compound fractures is a circumstance worthy of notice in a practical point of view. Such an occurrence is met with chiefly in hot weather, but I have also seen

it in the autumn and early part of winter, in consequence of the artificial heat of the patient's apartment. In tropical climates the formation of maggots in wounds and ulcers is often almost unavoidable, no matter what degree of attention may be bestowed upon cleanliness. Dr. Proctor, formerly of Kentucky, now of California, informs me that this was one of the great evils which our surgeons were obliged to encounter during our war with Mexico. Wounds carefully cleansed and dressed one morning, were found on the succeeding morning to contain great numbers of these animals; and if the slightest neglect took place they speedily collected in incredible quantities, and of prodigious size, their diameter equalling that of a small goose quill, while their length ranged from three to nine lines. The soldiers had a great horror of them, and from the disposition which they evinced to burrow deep among the muscles they were productive of no little pain and distress.

Fortunately the formation of maggots is not often seen in civil practice, where patients can enjoy all the conveniences and comforts of home; nor is it usual to meet with them in public institutions; still, the fact that such an occurrence is possible cannot be too firmly impressed upon the mind of the young and inexperienced practitioner.

The best preventive of this occurrence is cleanliness, with a frequent change of dressing, and burying the affected parts in light bran, so as to place them beyond the reach of flies, which, under almost any other mode of management, are sure to find their way to the wounded surface, the slightest crevice affording them access to the much coveted spot. Moisture and a high temperature are the causes which most rapidly conduce to the formation of maggots. The means that prove most destructive to them are spirits of turpentine, creasote, and alkaline solutions, particularly the chlorinate of soda.

Horrible suffering has been known to result from the development of maggots in the nose, from the accidental deposition of larvæ during a fit of intoxication. Dr. Bamford, who formerly practised in Texas, has communicated to me the particulars of the case of a man who perished from the effects of maggots formed in the nasal cavities and frontal sinuses, from which it was found impossible to dislodge them by any means that could be devised for the purpose. The patient suffered great agony, and died in raving delirium. It is easy to concieve how, in a hot climate, in consequence of the want of cleanliness, the larvæ of the fly might be deposited into an ear affected with profuse suppuration, or, from a similar cause, even into the vagina. Disgusting as such an occurrence is, its probability is by no means impossible.

SECT. VIII.—POISONED WOUNDS.

Under this head are included four distinct classes of wounds: first, those inflicted by venomous insects and snakes; secondly, those caused by the bite of rabid animals; thirdly, those produced by inoculation with the poison of glanders; and lastly, wounds received in the examination of dead bodies, constituting what are called dissection wounds.

1. WOUNDS INFLICTED BY POISONOUS INSECTS.

There are various genera of insects which naturally secrete a poison, which, when instilled into the living tissues, is capable of producing serious and even fatal consequences. Of these the most common, at least in this country, are the humble-bee, the honey-bee, the wasp, hornet and yellow-jacket. The poison of these insects is contained in a small vesicle in the abdomen, and is under the control of a peculiar muscular apparatus by which it is injected into the puncture made by the barbed sting of these little creatures. It is highly acrid in its qualities, especially in the honey-bee, hornet and yellow-jacket, transparent, and of a sweetish taste at first, but afterwards hot and disagreeable, being particularly active during the heat of summer. When roused to anger, these insects sting with great fury, producing a wound which is instantly followed by a sharp, pungent, itching pain, and in a few moments after by a circumscribed inflammatory swelling, pale, and elevated at the site of injury. In some persons, owing to idiosyncrasy and other causes, the symptoms are exceedingly severe and even alarming, the patient having dimness of sight, vertigo, nausea, palpitation, and a feeling of indescribable oppression, with a disposition to swoon. Instances have occurred in various parts of the country of persons having been stung to death by a single honey-bee; one such case, of which I have the particulars, occurred, many years ago, in Kentucky, in a man upwards of thirty years old. He was wounded on the face, and died in a few hours. I know a young man who always suffers from severe sickness of the stomach and great nervous depression when he is stung by a bee. Violent effects sometimes proceed from the sting of a bee, wasp, or yellow-jacket in the fauces, œsophagus, or stomach, when these insects are accidentally swallowed in cider and other drinks.

As the sting is often left in the skin, in the infliction of this class of wounds, the part should be carefully examined, in order that, if present, it may at once be extracted. The most promptly efficacious remedies are, in general, salt water, alcohol, laudanum, vinegar, hartshorn, spirits of camphor, Cologne water, soap liniment, solutions of the acetate of lead, and dilute tincture of iodine. Turpentine is also a highly valuable article. Whether these and other similar remedies act by neutralizing the poison, or merely by relieving the resulting inflammation, we are unable to say. In those cases in which the system becomes affected, immediate recourse should be had to internal stimulants, of which the best are brandy and ammonia. If the insect has passed into the throat, a mustard and salt emetic will be the proper remedy, followed, if urgent swelling and impending suffocation ensue, by leeches to the neck, and, perhaps, by laryngotomy.

Various species of the *mosqueto* tribes are poisonous, and therefore capable of inoculating the wounds which they make by their bite. In the Southern States, as well, indeed, as in some of the western, and along many parts of the Atlantic coast, the mosqueto abounds in vast numbers, and often inflicts serious injury both upon man and animals.

I have met with a number of instances in which the bite of this insect was productive of severe inflammation, and several in which it was followed by considerable ulceration. The late Professor Dorsey, of this city, observed a case of gangrene and death from a wound of this kind in a lady, previously in good health. So serious an effect as this is probably always dependent upon some idiosyncrasy, or upon the occurrence of erysipelas, consequent upon the bite. The stinging sensation and swelling which attend the application of the poison of the mosqueto usually soon subside of their own accord, or under the use of some mild stimulant, as Cologne water, alcohol, vinegar, or laudanum. When the effect is more serious, the tincture of iodine and warm water-dressing may be necessary.

The poison of the *scorpion* has many of the properties of that of the bee and wasp, although it is much more active. It is of a whitish color and oleaginous consistence, and is contained in a small reservoir near the end of the tail, whence it is ejected through two little pores on each side of the sting. In North America and Europe the wound inflicted by the animal is comparatively harmless, the only effect generally being a tolerably smart but transient inflammation; but in Africa and Asia it is often followed by great suffering and even loss of life, death sometimes occurring in a few hours. In these countries the scorpion frequently attains an enormous size, having a huge body, and a length of from six to ten inches. Several species of this insect, of large size, are found in Texas and Mexico, but I am not aware that their sting is particularly venomous. The great Eastern remedy in this variety of wound is olive oil, and an idea prevails that its virtues are greatly increased by infusing in it the bodies of some of these animals previously to its application. Spirits of hartshorn would doubtless be a more valuable addition. Such a wound should always be immediately well washed with salt water, then scarified, next thoroughly rubbed with volatile liniment, and then covered with an emollient poultice. If constitutional symptoms arise, they must be met with anodynes, brandy, and ammonia, the treatment being very similar to that adopted for the sting of the bee and wasp.

Bad effects have occasionally followed the bite of the *spider;* and the fabulous stories about the poisonous qualities of the tarantula are known to every reader of history. As yet, we know too little of the character and habits of these insects to speak with any certainty of the effects of their bite; but judging from what has been published upon the subject by reliable authorities, it is fair to conclude that, while there has been much exaggeration and actual misrepresentation, there is also much that is true. The symptoms of the bite of the tarantula, so far as they have been studied, would seem to be very similar to those produced by the sting of the common scorpion. Hence similar treatment would probably suffice.

2. WOUNDS INFLICTED BY VENOMOUS SERPENTS.

The number of poisonous serpents in different parts of the world is very considerable; but in this country there are, so far as is at present

known, only three genera that are at all dangerous on account of their bite. These are the crotalus, trigonocephalus, and elaps. Of the crotalus, or rattlesnake, so called from the peculiar appendage to its tail, Professor Holbrook, in his Herpetology of North America, has described not less than six species, of which the banded, striped, and miliary are the most common; all are venomous, and consequently capable of inflicting deadly wounds. These reptiles formerly abounded in almost every section of the United States, especially in the swampy and mountainous regions, but are now hardly ever met with in our denser settlements.

All the different species of rattlesnakes are provided with two small sacs, each of which contains a minute quantity of poison, and communicates, by means of a short excretory duct, with the canal in the fang on each side of the upper jaw. It is inclosed by a bony framework, situated external to the proper jaw, and is under the control of appropriate muscles, the action of which aids materially in expelling its contents. The fangs, situated just at the verge of the mouth, are very long, sharp, and crooked, like the claws of a cat, and are naturally retracted and concealed in a fold of integument; but, when the animal is irritated, are capable of being instantly raised, and darted forwards with great force into the skin, followed by an emission of poison. The snake, then, does not bite, but strikes, making a punctured wound.

The annexed illustration represents the head of the rattlesnake, and one of the poison fangs, with the canal along which the venom flows when the animal is in the act of inflicting its wound.

Fig. 63.

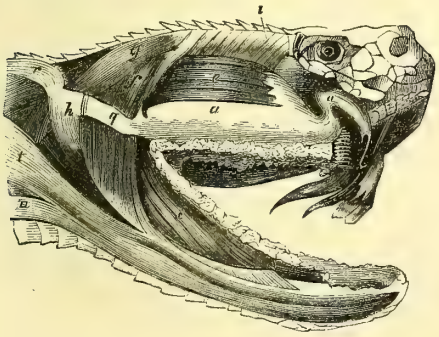


Fig. 64.

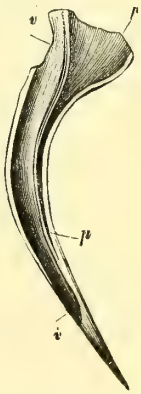


Fig. 63. Head of the rattlesnake. *a*, *a*. Poison gland, and its excretory duct; the latter cut open at its extremity. *e* Anterior temporal muscle. *f*. Posterior temporal muscle. *g*. Digastricus. *h*. External pterygoid. *i*. Middle temporal. *q*. Articulo-maxillary ligament, which joins the aponeurotic capsule of the poison gland. *r*. The cervical angular muscle. *t*. Vertebro-mandibular muscle. *u*. Costo-mandibular muscle.

Fig 64. Poison fang, magnified. *p*, *p*. The pulp cavity of the tooth. *v*, *v*. The canal along which the venom flows, truly on the outside of the tooth.

The poison of the rattlesnake is slightly yellowish, thin, and semi-transparent, resembling clear honey, its quantity not exceeding three

or four drops. It is peculiarly acrid and deadly in hot weather and during the procreating season. In winter and early spring the reptile is in a torpid condition, and the poison is then not only diminished in quantity, but unusually thick, and almost destitute of virulence.

The *effect* of the wound of the rattlesnake varies with many circumstances, as the situation of the part, the acrid character of the poison, and the age of the patient. Experience has shown, as in the case of the bite of rabid animals, that most of those hurt in this way escape either entirely or suffer only in a very slight degree; the poison either failing to reach the tissues, or being too inert to make any decided impression upon the system. It is also known that adults are less liable to suffer than children, simply because they possess, as may be supposed, greater vigor of constitution, and consequently greater power of withstanding the influence of the venom. The deleterious effects of the poison seem to be much weakened, if not actually exhausted, by a rapid succession of bites. The experiments of Captain Hall, of Carolina, and of the late Professor Barton of this city, place this subject in a very clear light. Of three dogs bitten in succession by a rattlesnake four feet long, the former gentleman found that the first died in less than fifteen seconds, the second in two hours, and the third in three hours. The subjects of Barton's experiments were chickens, and the results were almost identical with those of Hall. Of three fowls, bitten on three consecutive days, the first perished in a few hours, the second lived for some time, and the third finally recovered, although not without considerable suffering. Instances occasionally occur in the human subject of almost instant destruction from the bite of the rattlesnake; at other times the case proceeds more slowly, the patient not dying under several hours, or, perhaps, several weeks. Dr. Wainwright, of New York, lost his life in less than six hours from the time he was wounded. The animal, an uncommonly large one, had lain in a torpid state for some time, when, unexpectedly becoming warmed, he reared himself and struck his victim furiously on the last phalanx of the middle finger of the left hand. Although the wound was immediately sucked, and soon afterwards excised and cauterized, a ligature being also tied firmly round the wrist, the hand soon became enormously swollen, the tumefaction rapidly extending up the limb nearly as far as the axilla, and the surface, in the greater part of its extent, exhibiting a mottled bluish and greenish yellow hue. The pulse soon became very feeble, and beat one hundred and twenty in the minute; in four hours the patient was in a state of stupor, and died soon after in a completely comatose condition. Finally, in another series of cases, the patient, after having been near death's door for several weeks, eventually perishes, or recovers. When death occurs almost instantaneously, the probability is that the poison is injected directly into the blood, the fang having penetrated some tolerably large vessel. Under such circumstances, the blood is found to be thin and black, and refuses to coagulate when exposed to the atmosphere.

When this poison has been freely instilled into a wound, the *symptoms* will always be proportionably severe. The moment the inoculation has taken place, excessive pain is experienced in the part, rapidly

followed by swelling, which soon diffuses itself extensively over the surrounding surface, and is attended with a livid mottled appearance, dependent upon extravasation of blood in the subcutaneous cellular tissue. If the wound, for instance, occupies a finger, the tumefaction speedily extends up the limb, as far as the shoulder, and, perhaps, over a large portion of the corresponding side of the trunk, a feeling of numbness, weight, and coldness attending the other symptoms.

Within a few minutes after the first manifestation of the local affection, marked evidence appears of the absorption of the poison into the system. The patient looks excessively pale, sees objects indistinctly, is sick at the stomach, perhaps ejecting its contents, and has frequent swooning fits, with clammy sweats, and coldness of the body. By and by, as the system becomes more fully impressed with the deleterious effects, insatiable thirst arises; a sense of constriction is experienced in the chest; the breathing is oppressed; the pulse is feeble and vacillating; great anxiety and restlessness exist; the tendons twitch; the mind wanders, or is furiously delirious; and death soon closes the scene. In the worst cases of the affection, a universal yellowness of the skin is observed, and the parts are not only frightfully swollen, but, if the patient survive some hours, large vesicles appear upon the surface, containing bloody serum, and indicating the approach of mortification. When death does not take place for a considerable number of days, large abscesses form in the cellular substance and among the muscles, and the system gradually sinks under the resulting irritation.

The genus *trigonocephalus* includes several species, of which the water moccasin, or cotton-mouth, and the copperhead, are the most important. They have no rattles, but the upper jaw is armed with poisonous fangs, and their bite is said to be very deadly. The cotton-mouth snake is met with extensively in the Southern States, its northern limit being the Pedee River in North Carolina. Professor Holbrook states that it is the terror of the negroes about the rice plantations, being more dreaded by them than the rattlesnake, which only attacks when irritated, whereas the water moccasin makes war on everything that comes within its reach.

Of the genus *elaps*, the only species, according to Dr. Holbrook, known in this country, is the elaps fulvius, whose body, twenty inches in length, is of a beautiful red color, surrounded with black rings, margined with yellow. Its upper jaw is armed on each side with a permanently erect poisonous fang. It is found chiefly in the Southern States, in sweet potato fields, and is so gentle in its habits as to be regarded as almost harmless.

The most noxious serpent in the East Indies is the *cobra di capello*, the spectacled, or hooded snake, of which there are a number of varieties, all distinguished for their venomous properties. The effects of its bite are very similar to those which follow the bite of the rattlesnake, only that they are in general somewhat more tardy, and accompanied by less swelling. The poison is of a semi-transparent, yellowish appearance, not unlike olive oil. It has been known to kill a large dog in less than twenty minutes; and in the case of the keeper at the

Zoological Gardens in London, who was bitten by a cobra on the root of the nose, death occurred in ninety-five minutes. The internal viscera were found, on dissection, to be intensely congested, and the blood, which was dark, alkaline, and fluid, emitted a peculiarly acid and sickening smell.

In Europe, the common *viper* or *adder* is the most venomous serpent known. It is uncommon in England, but exists in considerable numbers in France, Spain, and Italy, as well as in several of the more northern States of the Old World. The poison, which has a yellowish oily appearance, may be swallowed almost with impunity, provided there is no abrasion upon the mouth. It is most active in hot weather, killing small birds and animals almost instantly. Applied to the human subject, it causes acute pain and diffuse swelling, followed by a puffy, œdematous state of the subcutaneous cellular substance, and a livid and vesicated condition of the skin. The general symptoms, which seldom manifest themselves under three-quarters of an hour to an hour, bear the closest possible resemblance to those produced by the wound of the rattlesnake.

A great deal has been written concerning the *treatment* of wounds inflicted by venomous serpents, and yet it is remarkable that we have not a solitary remedy upon which any reliance can be placed. The fact that so many articles have been recommended as specifics clearly shows that these lesions are often so slight as not to require any treatment at all, the unpleasant effects generally passing off spontaneously in a few hours, either because the poison has not been introduced in sufficient quantity, or because it has not been sufficiently noxious to produce any serious harm. The first thing to be done, as far as the part is concerned, is to constrict the limb as tightly as possible, a short distance above the wound, which is then to be instantly excised and cupped, the glass being retained as long as the blood is disposed to flow, when the surface should be well washed with the dilute tincture of iodine, the same remedy being thoroughly applied to the skin over the whole extent of the swelling. Subsequently, warm water-dressing, medicated with laudanum and acetate of lead, will form the most suitable application.

The practice of sucking the wound is of great antiquity, and we find that there have been men, from time to time, in different parts of the world who have made it their special occupation. The Psylli, of Africa, and the Mersi, of Italy, acquired great celebrity for their skill in this particular branch of business, and the custom still prevails among many of the Indian tribes of this continent. The operation, however, cannot be performed with safety if there be any abrasion upon the lips or in the mouth, and should therefore always give way to the cupping glass.

Professor Brainard, of Chicago, has suggested the practice of injecting a solution of iodine under the skin for the purpose of destroying the poison. The only objection to the procedure is the difficulty of administering the remedy, such accidents nearly always happening in places remote from the apothecary and the surgeon.

Pain must be relieved, and the strength supported by morphine and

alcohol, the latter being given, in any of its more common forms, to the utmost possible extent compatible with the patient's power of endurance. Whiskey seems to be the great remedy among the mountaineers of this country, for this class of wounds, and there can be no question, from what has appeared in the public prints upon the subject, that it is entitled to great consideration. The treatment should be rapidly pushed to inebriation, though such an occurrence is seldom to be looked for when there is such marked depression of the general system as so often attends this lesion. Ammonia might, perhaps, be advantageously combined with the alcoholic remedies, for there can be no doubt that it must, under such circumstances, be productive of benefit, whether we regard it merely as a stimulant, or as a neutralizer of the poison. Olive oil has been highly recommended as an antidote against snake bite; but, without wishing altogether to deny its claims to such distinction, I must be permitted to express my scepticism respecting its virtues. In the East Indies, the Tanjore pill formerly enjoyed great celebrity in the treatment of wounds inoculated with the poison of the cobra di capello and other noxious serpents, its efficacy being supposed to depend upon the arsenic which enters into its composition. Fowler's solution has also been much lauded for its supposed neutralizing qualities, especially of the poison of the ter-de-lance, a venomous serpent in the Island of St. Lucia; it is administered every three hours in doses of two drachms along with a small quantity of laudanum, until active vomiting and purging are induced. But none of these remedies are reliable, and my opinion is that no time should be wasted upon their exhibition.

As a means of neutralizing the effects of the poison of the rattlesnake, attention has recently been directed to the use of Bibron's antidote, particularly by Dr. William H. Hammond, of the U. S. Army, and Mr. Louis De Vesey of this city, by both of whom it has been successfully administered. It consists of bromine, bichloride of mercury, and iodide of potassium, in the proportion of five drachms of the first, two grains of the second, and four grains of the third, the dose of the mixture, which should be kept in a glass-stoppered bottle, being ten drops, to be repeated, if necessary, in twenty minutes. Professor Bibron, who had such confidence in the antidote that he allowed a rattlesnake to bite him on the lip and cheek, prevented all symptoms of poisoning by taking the medicine. Dr. Hammond, who first attracted attention to it in this country, employed it successfully in one instance in the human subject, and also, on several occasions, in the inferior animals. Mr. De Vesey had previously used it, with a similar result, in two men that had been badly bitten by the rattlesnake; and in the American Journal of the Medical Sciences for April, 1858, he has related the details of a series of experiments which he instituted with a view of testing the value of this antidote, all tending to establish its claims to confidence. Other trials of it have been made, and generally with a like gratifying result. It has failed in several instances in the inferior animals, probably on account of their small size, and the consequent rapid action of the poison. It has always, however, I believe, succeeded in the human subject. Five successful

cases of this mode of treatment in man have been reported by American physicians. It seems highly probable that the remedy would prove efficacious in other forms of animal poisoning than those arising from the bite of the rattlesnake.

3. WOUNDS INFLICTED BY RABID ANIMALS.

There is a peculiar disease among man and animals known by the name of hydrophobia, its characteristic symptoms, at least in the human subject, being a dread of water, as the term by which it is generally designated literally signifies. It is due to the influence of a particular poison, which is generated by certain animals, and which is capable of propagating the disease by inoculation. Of the nature of this poison we are ignorant; we only know that it is contained in the saliva, and that, after having remained latent for some time in the wounded part, it is absorbed and carried into the system, where it produces the peculiar effects by which the malady is characterized.

That the *virus* of hydrophobia resides in the saliva, or in the saliva and other secretions of the mouth and fauces, is a circumstance which has been fully established by experiments upon inferior animals. Thus, Dr. Zine inoculated a dog, cat, hare, and cock, with the saliva of a rabid dog, and readily induced the disease. Similar results followed the investigations of Dupuy, Youatt, and other veterinary surgeons. The former of these pathologists rubbed a sponge wet with the saliva of a mad dog upon the sore of a sheep, which subsequently perished from hydrophobia; and the latter communicated the affection from one brute to another by means simply of a silk thread, impregnated with this fluid and used as a seton. While hydrophobia, however, may be readily propagated in this manner, we are ignorant as to the precise source of the poison, whether, although it is contained in the saliva, it is really secreted by the salivary glands, or whether it is derived from the mucous membrane of the mouth and fauces. The former supposition is certainly the more plausible of the two, but the fact could only be verified by taking the fluid directly from one of these organs; an experiment which, so far as I am aware, has never been made.

There are certain animals which have the faculty of generating the poison of hydrophobia spontaneously; they belong chiefly, if not exclusively, to the canine tribe, and consist of the dog, wolf, fox, jackall, and badger. The cat is commonly supposed to possess a similar power, but facts are still wanting to settle the question. Man and other animals do not generate the virus spontaneously, but are susceptible of the disease, and are probably all capable, with the exception of man, of propagating it when under its influence. Breschet repeatedly provoked the disease in dogs by inserting into them the saliva of rabid horses and asses; and several cases have been reported where human beings had the disease communicated to them by horses and pigs. It is not certain whether hydrophobia can be propagated from one person to another. The facts which we have upon this subject are too few to justify any definite expression of opinion. In

the case of Mr. Wheeler, a dresser in Guy's Hospital, London, who was bitten by a rabid patient, no ill effects followed, and I know of no well authenticated instance of the disease having been induced in this wise. Rabbits and similar animals, as well as fowls, soon die from inoculation with this poison, without exhibiting any of the ordinary symptoms of hydrophobia.

The *inoculation* in hydrophobia is usually effected by a tooth, which, however, need not necessarily penetrate the true skin, numerous cases having occurred where the disease was communicated by the slightest scratch, or abrasion. One instance has been reported where death was produced by the licking of a wart upon the face, by a little poodle supposed to have labored, at the time, under rabies. It is, indeed, not improbable that the disease may be communicated merely by the contact of the saliva of a hydrophobic animal with sound skin and mucous membrane. It is also supposed to be possible that a mother may transmit the affection to her infant through her own milk. Cases now and then occur which lead to the suspicion that the disease may be induced by dogs and other animals not actually mad, but simply enraged; whether this, however, is a fact or not remains to be proved. Finally, experiments have been performed which go to show that the morbid saliva may be administered internally with entire impunity.

The period of *latency* of this disease varies from a few weeks to several months. In eighty-nine cases, analyzed by Dr. Blatchford and Dr. Spoor, of Troy, the average period was about seventy days, the minimum in twenty-three cases was thirty days and under, and the maximum in six cases was upwards of two hundred days. In the only two cases of hydrophobia that I have ever seen, the disease appeared, in one, at the end of four weeks, and in the other at the end of nine months from the date of the inoculation. According to John Hunter, the extremes range from thirty days to eighteen months. An English writer, Dr. Bardsley, refers to an instance where the disease did not show itself for twelve years, but such a statement must be received with proper allowance. The period is generally considerably shorter in animals than in man.

Although a considerable period always elapses between the inoculation and the appearance of hydrophobic symptoms, yet it is extremely probable that the virus is speedily absorbed into the system, though some time is necessary to develop its zymotic properties. What countenances this view of the subject is that nearly all the other known poisons, when brought in contact with the living tissues, are promptly absorbed, so as to make, sooner or later, their peculiar impression upon the constitution. The poison of the rattlesnake is taken up almost instantaneously, and the probability is that the same is true with respect to the poison of smallpox, measles, scarlatina, and other zymotic affections. A certain period, however, is necessary, in every case, to enable the poison to explode upon the general system, or, in other words, to multiply itself, and extend its influence. With regard to the virus of rabies, it is certain that the disease is often developed within the usual period, after the most prompt and complete excision of the bitten parts.

Many persons are bitten by rabid animals who yet never contract the disease, the virus having either been exhausted before the rencontre takes place, or, what is more probable, having been wiped off by the clothes in the act of inflicting the wound. In this way more than half of those bitten occasionally escape with impunity; but, on the other hand, it sometimes happens that nearly every one is effectually inoculated. It is not impossible that idiosyncrasy may exert an important influence in the production of the disease. It is well known that this is true of other zymotic poisons, and it is therefore reasonable to suppose that it may also hold good of this. Out of fifty dogs that had been inoculated by Dr. Hertwich, of Berlin, with saliva taken from a rabid animal of the same species, not one in five was infected.

Hydrophobia occurs at all *ages*. It has been observed in infants at the breast, in children, and at every period of adult life. In the Transactions of the American Philosophical Society are the particulars of a case in a man of seventy-three. Women are equally as subject to the disease as men, and, if they suffer less frequently from it than they do, it is simply because they are less exposed to the attacks of rabid animals. It prevails in all countries, in all climates, and at all seasons of the year. Northern Europe, however, has furnished a greater number of cases than perhaps any other part of the world. It is also frequent in England; and, as a general rule, it is more common in northern than southern regions. Throughout the West Indies it is comparatively rare, although the number of dogs there is unusually great as compared with the number of inhabitants. Hydrophobia is more common in Canada and New England than in the Southern States of the Union.

The *symptoms* of rabies necessarily divide themselves into local and constitutional; or those furnished by the wounded part, and those afforded by the system, after the absorption of the specific virus.

The wound inflicted by a rabid animal generally heals as kindly as any similar wound made by a sound animal; the scar, perhaps, remaining a little red and tender, as it usually does after an ordinary bite, but exhibiting no other peculiarity, and the system being perfectly free from disease. By and by, however, when the period of incubation is about to draw to a close, the part begins to itch, burn, or smart, and soon becomes sore and irritable, hot, numb, or rigid, pain darting through it in different directions, and sometimes extending to a considerable distance beyond the site of injury, as from the hand up to the shoulder, or from the foot to the knee or groin. Sometimes a red line can be traced in the direction of the lymphatics. Occasionally, though rarely, the cicatrice has been known to open afresh. Almost simultaneously with the local affection evidence of general indisposition appears. The patient feels unwell; his head aches; his sleep is disturbed by unpleasant dreams; he feels melancholy and depressed; and he has occasional attacks of chilliness, with a highly impressible state of the system. The poison is now fairly at work, and in a few hours—generally from ten to twenty-four—explodes with frightful violence. The period of latency is passed; the disease has reached its second stage; the dread of water and the difficulty of deglutition have declared themselves;

in a word, hydrophobia is fully established. The patient, on attempting to drink, is suddenly seized with spasm in the throat, and finds that he is unable to swallow a particle of fluid; he tries and tries, but every effort is only succeeded by a renewal of suffering, and presently he dashes away the cup as if it were charged with some deadly poison, unwilling again to bring it to his lip. Tortured with thirst and a sense of dryness of the mouth, he will rather endure his discomfort than subject himself to the dreaded spasm. Should he succeed in forcing down a little water, he will be instantly seized with suffocative cough, convulsive tremors, and lividity of the face, compelling him to jump up in bed, and to pant for breath. The painful sensations are usually referred to the throat, and are often accompanied by a feeling of constriction in the chest, difficulty of respiration, a disposition to sigh, and a frequent desire to clear the mouth and fauces, which soon become clogged with an inordinate secretion of thick, viscid saliva and mucus, which greatly aggravate the patient's suffering. At this stage of the disease, and generally, indeed, before it has reached this point, there is superadded to the previous distress a remarkable susceptibility to atmospheric impressions, the slightest contact of cold air being a source of profound torture, producing a sense of suffocation, and even violent convulsions. The agony thus occasioned is sometimes much greater than that caused by the attempt to swallow fluids. The least opening of a door, the slightest motion of a fan, or even the smallest whiff of air directed from the attendant's mouth upon the body, instantly brings on a paroxysm of this kind. Light and noise too are always offensive; and hence the patient usually insists upon his room being kept dark, quiet, and closed. The mind, at this stage, is peevish and fretful; and nothing that can be done can please the sufferer, who, in consequence, often quarrels with his best friends. At times his imagination is completely perverted; he fancies that he hears noises and sees objects that have no real existence; he gets out of bed, walks about the room, screams, or gesticulates, very much like one affected with delirium tremens.

In the last stage, which is characterized by an aggravation of all the previous symptoms, the countenance has a haggard and distressed appearance, horror and anxiety being depicted on every feature; the eyes have a wild and glaring expression; the tongue is perfectly dry and parched; the strength is much impaired; the voice is hoarse and shrill, almost like that of a dog; the respiration is short and panting; more or less delirium is present, often amounting to complete mania; and the pulse, small and feeble, beats from one hundred and thirty to one hundred and sixty in the minute. Thus the disease progresses, paroxysm after paroxysm recurring until the frame is worn out by exhaustion, death usually taking place suddenly in a fit of suffocation. Occasionally a slight calm is experienced a few hours before the fatal event; the spasms almost completely subside, the power of swallowing returns, the mind becomes clear, and the patient, perhaps, sinks into a tranquil sleep. The duration of the attack varies from eighteen hours to a week, the average being about three days.

In a case of hydrophobia which I attended in 1842, the patient, a young man of about twenty-one years of age, was attacked pre-

cisely five weeks after having been bitten in the left hand by a rabid dog. When I was called in the disease was in its second stage, well-marked symptoms having appeared the previous day. The difficulty of swallowing and the morbid sensibility of the skin were present in a high degree. Every effort at drinking, nay, the very mention of fluid of any kind, and the attempt to raise the glass to the lip, caused violent convulsions; the countenance was flushed and tumid; the eyes red and suffused; the mouth parched; the throat stopped with viscid mucus; the pulse frequent and rather strong; the respiration hurried; the thirst and restlessness intense; the mind exceedingly peevish and irritable; and the sensibility of the skin so exalted that the slightest approach of a current of air, inappreciable by any one else, produced the most horrible torture. The inability to bear light and noise was also very great. The hand felt numb and painful, though the wound had not reopened. These symptoms gradually progressed, increasing steadily in severity, until towards the end of the third day from the attack, when the young man expired in a state of complete exhaustion. The pulse, during the latter stage of the malady, was exceedingly irregular, and upwards of one hundred and fifty in the minute; the breathing was short and panting; and the mind was excessively agitated and distressed, but clear and intelligent, except when the patient was on the verge of a convulsion. The voice was not materially affected.

It is impossible to mistake hydrophobia for any other disease. The dread of water, the difficulty of deglutition, and the dread of cold air, are always sufficiently diagnostic of the affection, even when no history of it can be obtained.

The *dissection* of persons dead of this disease has thrown no real light upon its seat and pathology. In the case of a young man of twenty-four, who died in 1840, nine months after he had been bitten on the hand, and whose body I assisted in examining, no lesion whatever could be detected, by the closest scrutiny, anywhere. The mouth, fauces, pharynx, and œsophagus, the larynx, trachea, and bronchial tubes, where disease might naturally be supposed to exist, under such circumstances, were perfectly free from morbid appearances. The brain and spinal cord, the lungs, stomach, bowels, and other viscera, were in as natural a condition as I ever saw them in any case. Occasionally, especially in protracted instances, the membranes of the brain have been found congested, and the ventricles partially filled with serum. The stomach, œsophagus, and pharynx have also been found inflamed; and several dissections are mentioned where pus was discovered in some of the larger joints. Very little reliance, however, it seems to me, should be placed upon the statements that have been published upon the subject, especially when we consider the loose manner in which most of them are drawn up, and the fact that comparatively few men are competent to make accurate dissections of dead bodies.

The *prognosis* of hydrophobia is always bad, the disease invariably ending fatally. If there is a case of recovery, of a reliable character, upon record, I am not aware of it. I know that a number of instances

have been published in which the patient is said to have gotten well, but there is not a single one, so far as I am acquainted with them, that can withstand the test of scientific scrutiny.

The period at which death occurs is, in general, very short. The average in seventy-two cases, analyzed by Dr. Blatchford and Dr. Spoor, was three days. In one hundred and twenty cases, analyzed by Dr. J. L. Smith, of New York, sixty-five perished in from one to two days. In some instances, the disease proves fatal during the first twenty-four hours, while in others this event does not happen until the tenth day, although when postponed so late it necessarily creates some doubt in regard to the true nature of the case.

In the *treatment* of this variety of poisoned wound, reliance must be placed solely upon preventive measures; for, as has just been seen, when the disease is once developed, there is no possible chance of doing anything more than mitigating the suffering, and even that only in a slight degree. If, as I have supposed, it be true that the poison is speedily absorbed after being brought into contact with the living tissues, the importance of promptly dislodging it cannot be too fully impressed upon the attention of the practitioner. As soon, therefore, as such a case is presented to his notice, the injured part should be thoroughly excised, care being taken to embrace a portion of the sound tissues. The flow of blood is then to be encouraged with a cupping glass, retained for some time, when the raw surface is well cleansed, and immediately cauterized with nitrate of silver. If the teeth of the rabid animal have penetrated between two bones, as, for example, when the bite has been inflicted upon the hand, excision must be performed with increased care, otherwise a portion of virus will be almost sure to be left behind. In such a case it might become a nice question to determine whether the operation should not be made to include a portion of the bones also; for almost any local sacrifice is justifiable to secure immunity from so horrible a disease. It would seem from the observations of Mr. Youatt and Mr. Blane, two eminent veterinary surgeons, that there is no remedy which so certainly neutralizes this poison as nitrate of silver. The former of these writers, whose opinion is entitled to the greatest respect, on account of his large experience in the treatment of canine madness, has repeatedly employed this article, under these circumstances, in his own case, and such is his confidence in its virtues that he regards it in the light of a specific. His plan is to cleanse the parts well in the first instance with soap and water, and then to use the caustic most thoroughly, previously enlarging the wound, if necessary. If I were so unfortunate as to receive such an injury upon my own person, I should certainly feel more confidence in my escape, if the wounded parts had been excised and cupped prior to the cauterization.

Excision should also be practised when the injured part has been neglected, or imperfectly removed in the first instance, it being well known that the individual may escape the constitutional effects of the disease even after the wound has partially reopened. But even if there were no reasonable hope of preventing the occurrence of the disease by this procedure, it should, nevertheless, be practised, if for no

other reason than that it will have a soothing effect upon the mind of the poor sufferer. Everything calculated to allay his fears and contribute to his happiness is justifiable under such trying circumstances. If the symptoms of hydrophobia, however, are already developed, neither such an operation, nor even the amputation of the limb above the site of injury, will be of any service.

When the poison has reached the system, and has evinced its explosive effects, no treatment, however judiciously and perseveringly conducted, can be of any avail as a curative agent. The experience of two thousand five hundred years fully attests the truth of this statement. There is hardly an article of the materia medica, potent or impotent, vegetable or mineral, that has not been used, singly or combinedly, for the cure of this disease, and yet, as was mentioned in a previous paragraph, there is not one solitary instance, of a reliable kind, upon record, where any beneficial result followed its exhibition. I need, therefore, not recount the various methods of treatment spoken of by authors, as this would only be a waste of time and space. Nor shall I say anything of internal prophylactics, experience having shown that there are no such remedies in hydrophobia.

To relieve the frightful suffering from the disease, chloroform and ether, either alone, or variously combined with each other; morphia in large quantities in the form of enemas; the application of steam conveyed to the patient's body as he lies in bed; and the exclusion of cold air, noise, and light from the apartment; constitute the most reliable means. General bleeding, the hot bath, and tartar emetic, so much vaunted by some, will only, as a general rule, expedite the fatal issue, without affording any decided mitigation of the suffering. Opium is of no use, even if given in enormous quantity, as the stomach does not appear, in this disease, to have the power of dissolving it. If anodynes are exhibited at all internally, they should be used in the form of morphia, laudanum, or black drop. Dr. Physick, with a view of relieving the difficulty of breathing, and preventing suffocation, advised laryngotomy, but I am not aware that it has ever been practised, or, if practised, that it has ever done any good. It certainly could not cure the disease, and it admits of doubt whether it would even moderate the spasm.

Hydrophobia in the Dog.—In concluding the subject of hydrophobia, a few words may be said respecting the character of this disease as it occurs in the dog, as it is important for the practitioner to be able to judge of the probability of his having been mad in the event of his having bitten a human being.

How the disease originates in the dog, one of the animals in which it is generated spontaneously, is not ascertained. It has been supposed that sexual abstinence, the use of filthy and unwholesome food, too close confinement, and extremes of heat and cold, constituted so many causes of the malady; but it is obvious that, although this may be true, yet our knowledge at present amounts to nothing but conjecture, which further and more carefully conducted observation alone can either verify or disprove. The average period of incubation is about

forty days, the minimum being a fortnight, and the maximum three months and a half.

The early symptoms of rabies in the dog are thus graphically described by Mr. Youatt: "In the greater number of cases," he remarks, "there are sullenness, fidgetiness, and continual shifting of posture. When I have had opportunity, I have generally found these circumstances in succession. For several successive hours perhaps he retreats to his basket or his bed. He shows no disposition to bite, and he answers the call upon him laggardly. He is curled up, and his face is buried between his paws and his breast. At length he begins to be fidgety. He searches out new resting-places; but he very soon changes them for others. He takes again to his own bed; but he is continually shifting his posture. He begins to gaze strangely about him as he lies on his bed. His countenance is clouded and suspicious. He comes to one and another of the family and he fixes on them a steadfast gaze as if he would read their very thoughts. 'I feel strangely ill,' he seems to say: 'have you anything to do with it? or you? or you?' Has not a dog mind enough for this? If we have observed a rabid dog at the commencement of the disease, we have seen this to the very life." Delirium is an early and characteristic symptom; the dog sees imaginary objects, and often springs at them with a furious dart; he is restless and excessively irritable, gazing wildly around, and snapping at everything within his reach. The saliva is secreted profusely, and collecting at the corners of the mouth, the animal makes frequent attempts to detach it with his paws; his appetite is strangely perverted, and he will sometimes greedily devour horse-dung, or even his own excrements; the voice is changed in its character, being generally hoarse, and more or less shrill: the eyes are singularly bright; and the thirst is intense and insatiable, the dog drinking frequently, and having no fear whatever of water, as is the case with the human subject.

The disease is now in full force, and tending rapidly to a fatal issue. The muscular powers being greatly exhausted, the animal finds it difficult to sustain himself upon his limbs; he reels and staggers about, like a man in a drunken fit; his tail is depressed, and the tongue protruded; the eyes have lost their brightness, and are of a dull, glassy appearance; the respiration is hurried and panting; finally, worn out by his suffering, the poor creature dies, either from convulsions, or from sheer exhaustion, the duration of the attack varying from three to five days. The power of communicating the infection exists, according to Youatt, in all the confirmed stages of the disease, and continues even for twenty-four hours after the death of the animal.

4. GLANDERS, FARCY, OR EQUINIA.

The horse, ass, and mule are capable of spontaneously generating a disease, which, although it affects the whole system, explodes with peculiar force and virulence upon the mucous membrane of the nose, causing violent inflammation and a copious discharge of thick, fetid

matter. It is accompanied by a pustular eruption of the skin; and the name by which it is generally known is glanders, from the fact that it is always associated with disease of the maxillary glands and of the lymphatic ganglions of the ear and neck. There is a form of the affection which is characterized by the development of small tumors beneath the skin in different parts of the body, varying from the size of a pea up to that of a hazelnut, of a spherical shape, very hard, almost immovable, and generally exquisitely painful to the touch. When very numerous, they give the surface a remarkably tuberculated appearance. To this disease the term *farcy* is commonly applied; and an attempt has been made by several writers to establish for it a distinctive character. Others, on the contrary, assert that it is identical with glanders, differing from it only in its location, or in the character of the structures in which it appears. This view of the case derives confirmation from the fact that the two affections often coexist, which would hardly happen if they did not possess a strong natural affinity for each other.

It has been observed that the animals in which this disease arises spontaneously are generally half-starved, over-worked, and of broken constitution. Whatever, however, the cause may be by which the affection is originally engendered, it is certain that it is both contagious and infectious, and that the strongest and most healthy animals will often speedily contract it when exposed to its influence; confinement in damp and ill-ventilated stables, especially if underground, powerfully predisposing to its occurrence. It was at one time thought questionable whether the disease could be propagated by atmospheric agency; but multiplied observation has long since fully settled that point. It would seem, indeed, that the air of an infected stable, after all the wood work, pavement, and plastering have been completely replaced, and every possible precaution used in regard to cleanliness, is capable of reproducing the disease in all its former severity.

The fact that glanders may occur in the human subject was first enunciated by Mr. Muscroft, in the Edinburgh Medical and Surgical Journal, in 1821. The case which he therein reports was that of a man who had accidentally inoculated his hand in cutting up for the kennel a horse that had died of this disease; violent symptoms soon showed themselves, and he expired in great agony at the end of a week. Since that time a number of similar examples have been recorded by other observers, thus indisputably establishing the transmissibility of glanders from animals to the human subject. As yet no facts had occurred proving that the affection might be communicated from one human being to another, or from man to beasts. In 1840, however, a case of this kind took place at St. Bartholomew's Hospital, London, which conclusively settled the question. The patient, a knacker, died of glanders, and the nurse who attended him took the disease and also perished from it.

These facts regarding the transmissibility of glanders from animals to man, from man to man, and finally from man to beasts, are of great pathological interest, and serve to inculcate the indispensable necessity of caution on the part of the professional attendants and nurses in

their intercourse with individuals laboring under this horrible disease; since the smallest particle of the specific virus coming in contact with an abraded surface, or even the mere inhalation of the infected air of the patient's apartment, may give rise to the malady.

In the equine tribes of animals, glanders may be propagated by *inoculation* with the pus and mucus of the pituitary membrane, the fluids being inserted under the skin with a lancet, or rubbed upon the greasy heel of the horse. It may also be produced by applying these secretions to the mucous lining of the nose; and a curious case has been reported of its having been caused by introducing balls of farcied matter into the stomach. An experiment performed by Mr. Coleman, the distinguished veterinarian, shows that the blood of a glandered animal, transferred to the carotid artery of a sound one, will rapidly engender the malady in its most virulent form.

The period of *latency* of this disease is generally very short, rarely exceeding two or three days. It is probably a little longer in the human subject than in animals, but the difference, if any, is very slight. It has already been seen that the first case that ever occurred, so far as is ascertained, in the human subject, terminated fatally at the end of a week from the time of the inoculation. The first local evidence of the disease is generally some swelling and tenderness of the maxillary glands and inflammation of the mucous membrane of the nose; sometimes the one, and at other times the other taking precedence.

The *symptoms* of this disease naturally divide themselves into constitutional and local. Shortly after the inoculation has taken place, the patient begins to feel unwell; his head, back, and limbs ache; chilly sensations, alternating with flushes of heat, creep over his body; sleep and appetite are impaired; the strength sensibly diminishes; the joints are stiff and sore; the spirits are depressed; the stomach is irritable; and the bowels are costive. After the lapse of thirty-six to forty-eight hours, sooner or later, a severe and protracted rigor generally occurs, followed by violent fever and profuse perspiration; an evidence that the stage of incubation is passed, and that the poison has gained full admission into the system. The symptoms now rapidly assume a typhoid character. The pulse becomes quick, frequent, and tremulous; the tongue is dry and brownish; sordes accumulate upon the gums and teeth; the voice is weak and often husky; the respiration is short, panting, and accompanied by a sense of constriction across the chest; the surface is bathed with fetid, clammy perspiration; the thirst and jactitation are excessive; the urine is scanty and high colored; the alvine evacuations are slimy and excessively offensive; the mind wanders; and the pains are atrocious.

Coincident with these phenomena are marks of serious disease of the mucous membrane of the nose, which is highly inflamed, and the seat of a copious, viscid, and irritating discharge. Excessive pain and soreness exist in the forehead, over the frontal sinuses, evidently from an extension of the inflammation to the lining membrane of those cavities; and for the same reason there is generally great uneasiness in the throat and larynx. The nose and cheeks soon become hot, swollen,

purple, excoriated, and exquisitely painful; the discharge from the nostrils assumes a bloody, purulent character, and is both copious and disgustingly offensive; the eyelids are infiltrated and nearly closed; and the features are hideously disfigured. About the tenth or twelfth day hard pustules make their appearance on various parts of the body, especially on the trunk, face, genital organs, and inside of the limbs, resembling those of smallpox, and attended with profuse fetid sweats. Occasionally they are accompanied by black bullæ, which, breaking, discharge a thin, sanious fluid, and bring into view gangrenous spots, varying from the size of a three cent piece to that of a quarter of a dollar. In some cases, again, numerous tubercles appear in different situations, interspersed among the pustules, or pustules and vesicles; they are generally small, of a roundish shape, hard, and exceedingly painful; as the disease proceeds, they give way on the surface, and exude a thin, ichorous fluid. The lymphatic ganglions of the groin, axilla, and other regions, frequently participate in the disease, becoming enlarged, tender, and painful; the lungs are also apt to suffer, and, indeed, it is not uncommon to see serious involvement of various viscera.

As the disease progresses, the prostration rapidly increases; the fever displays a more malignant character; deep coma supervenes; and the body exhales a horribly offensive odor, almost characteristic of the disease, and strongly denotive of the dissolved state of the blood and the putrescent nature of the secretions.

The period at which death occurs varies from eight or ten days to four or five weeks. In a majority of the reported cases, the disease terminated fatally before the eighteenth day; some of the patients died as early as the end of the first week, while a few lived until after the fiftieth day.

When glanders pursues this rapid course it is said to be acute, and chronic when it is more tardy. In the former case, the local symptoms usually precede the general, frequently setting in within a few hours after the absorption of the virus. The inoculated part becomes red and tender, and the epidermis is soon elevated into a vesicle, or pustule, from which the inflammation rapidly extends along the lymphatic vessels as high generally as the glands of the groin or axilla. The swelling is excessive; the limb is stiff and numb; and the areolar tissue, infiltrated with sero-albuminous exudation, before long becomes the seat of numerous abscesses. In the more severe cases, black spots appear upon the surface, indicative of the existence of gangrene. Sometimes the local disease begins in the lymphatic ganglions of the groin or axilla, from which it spreads over the corresponding side of the trunk and even over the whole limb.

In contemplating the progress of this disease, it is impossible not to be struck with the resemblance it bears to that of a dissection wound. It evidently belongs to the hemo-toxic class of affections, consisting essentially in a disorganized condition of the blood and solids, paralyzing and crippling the heart and brain, and thus bringing about that typhoid condition of the system which forms so prominent a feature of the complaint.

Dissection always discloses the existence of serious lesions in the nose and internal organs. The pituitary membrane, of a deep purple or livid hue, is coated with tough, viscid secretions, studded with tubercles, ulcerated at some points, and gangrenous at others; the nose is occasionally nearly eaten away; and large cavities generally exist upon the cheeks. The frontal sinuses, larynx, and bronchial tubes are livid and excessively congested; and the lungs often contain abscesses, occupied by ill elaborated matter, looking more like aplastic lymph than genuine pus. The heart is commonly softened. The mucous coat of the stomach and bowels is diminished in consistence, discolored, and sometimes studded with minute tubercles, similar to those observed in the nose. The pustules which exist beneath the skin and in the cellular tissue among the muscles, bear a great resemblance, in the nature of their contents, to metastatic or multiple abscesses; they contain no real pus, at least not in their earlier stages, but a dense, solid fibrinous matter, strikingly like that so generally found in pyemia and other forms of blood-poisoning.

The *diagnosis* of glanders is generally sufficiently easy. An inexperienced practitioner, deceived by the aching pains and soreness of the joints and limbs, might possibly mistake it in its earlier stages for rheumatism; but the occurrence of secondary symptoms would soon dispel the illusion. From the effects of a dissection wound it may be readily distinguished by the peculiar discharges from the nose, and by the character of the cutaneous eruption. The history of the case, too, will furnish important diagnostic data, and should therefore always receive due consideration. The fact that the patient has nursed or examined a glandered horse or person, will generally of itself afford strong presumptive proof of the true character of the attack. In the latter stages of the disease, the nasal discharges, the existence of pustules, abscesses, and gangrenous spots, and the horribly fetid exhalations from the body, are signs which it is impossible to mistake.

The character of the *prognosis* in this disease may be gathered, in great measure, from what precedes. The acute form of the disease is nearly always fatal. Of fifteen cases, collected by Rayer, only one recovered. The danger in chronic glanders, on the other hand, is much less. Thus, of ten cases, mentioned by the same writer, seven recovered and three died.

The *treatment* of this affection is preventive and curative. The former consists in the adoption of proper measures for destroying the poison at the earliest moment after inoculation has taken place. With this view the affected or abraded surface should be freely washed by holding it for a considerable length of time under a concentrated stream of water, and then thoroughly cauterized with acid nitrate of mercury, or some other active escharotic, or, what is better, effectually excised. If the operation be impracticable, and the wound is of a punctured nature, it should at once be enlarged, and then brought fully under the influence of some caustic, otherwise a portion of the poison lurking deep in the wound, may escape its contact, and thus be absorbed into the system. If a person is known to have died of glanders, the safest plan for the practitioner is to avoid a post-mortem

examination, especially if there is the slightest probability of there being any abrasions upon his hand and fingers.

The curative treatment, if it deserve such a name, has hitherto been entirely unavailing. Bleeding, both local and general, purgatives, tonics, and stimulants, have proved alike useless. Obviously our chief reliance must be upon the employment of supporting measures, especially quinine, carbonate of ammonia, tincture of the chloride of iron, and brandy, given in large and frequently repeated doses, in combination with liberal quantities of morphine, with a view both of allaying pain and controlling gastric irritability. Infiltrated fluids and abscesses should be promptly evacuated, and the affected parts wrapped up in flannel wrung out of saturnine and anodyne lotions. The nose should be frequently injected with tepid water impregnated with creasote, or tannate of iron; liquid chlorinate of soda should be freely sprinkled upon the body and bedclothes; the apartment should be constantly ventilated; and the utmost attention should be paid to cleanliness. To these means should be added, in chronic cases, change of air, or residence near the sea-coast.

5. WOUNDS INOCULATED WITH A PECULIAR SEPTIC POISON GENERATED IN DEAD ANIMAL BODIES.

a.—*Dissection Wounds.*

Wounds contracted in the examination of dead human bodies are named dissection wounds, and are deserving of special attention from the severe effects they are capable of producing. These injuries generally occur in the form of punctures, abrasions, or slight incisions, and would, in general, be altogether unimportant if it were not for the fact that they are often inoculated with a peculiar poison, septic in its character, and therefore liable, if absorbed, to contaminate both the part and system. The instruments with which they are usually made are the scalpel, tenaculum, and needle, especially the latter, as it is very apt to prick the fingers in sewing up dead bodies. Not unfrequently the inoculation is effected through the medium of a pre-existing abrasion, or scratch, of the presence of which the person may, at the time, be perfectly unconscious.

Of the nature of the poison which produces these severe effects nothing whatever is known. It is supposed that it is generated a short time before death, during the act of dying, or soon after dissolution, and that it is dependent for its development upon a vitiated state of the blood, though that state has not been pointed out. The idea is certainly plausible, supported as it is by the circumstance that the poison is generally most virulent when it is communicated by persons dead of puerperal fever, erysipelas, carbuncle, pyemia, carcinoma of the liver, and other kindred affections. Once formed, it becomes, like the virus of chancre, independent of the source whence it was derived. A good illustration of this fact was afforded me, a few years ago, in the person of a young cutler, who, in sharpening a case of dissecting instruments for me, which had not been used for nearly five

months, slightly pricked one of his fingers. The consequence was that the hand and arm soon became exceedingly painful, as well as a good deal swollen, a characteristic red line extending up as high as the axilla, the glands of which were also in a short time involved in the disease. Nearly a month elapsed before he recovered from the immediate effects of his injury. A prick of the finger received in cleaning bones has sometimes been followed by severe suffering, and even loss of life. It is generally supposed that fresh bodies are more liable to convey the poison than such as have been kept for some time. This, however, is not always true; for in a subject which had been on hand for nearly a month, and which I dissected, in 1827, with Dr. Temple, of Virginia, that gentleman came very near losing his life from a little puncture which he received at the end of that time. It is worthy of remark that the body was that of an old female, who had perished from the effects of tertiary syphilis, as was apparent from the extensive disease of the skull and other portions of the skeleton, and that the attack of my friend was one of extraordinary severity.

Violent effects sometimes follow the dressing of wounds, in consequence of the contact of foul and irritating discharges, and several instances are upon record where surgeons have lost their lives from this cause. Similar results occasionally occur during the removal of cancerous growths, from inoculation with the secretions of the affected structures. The health of Professor Dudley, of Lexington, suffered seriously for several years from the inoculation of the hand with the matter of an encephaloid tumor during the amputation of an arm, performed for the purpose of getting rid of the disease. Dr. Physick met with a case where death occurred from the effects of a slight scratch with the shell of an oyster, received in the act of opening the animal.

The period of *latency* of this poison is usually short, or, more properly speaking, only a short time elapses before the occurrence of well marked symptoms; for it is extremely probable that it begins its peculiar operation upon the inoculated structures almost immediately after its introduction, although its explosive effects may not manifest themselves nearly so soon. Generally they do not come on before the end of the second day, or the commencement of the third. In one case—the most remarkable, in this respect, on record—the symptoms were quite severe within the first twelve hours, and the patient died in forty hours from the receipt of the wound. In the case of Dr. Temple, above alluded to, violent indisposition ensued in less than thirty-five hours from the time he pricked his thumb. The accident happened late on a Saturday night, and on the following Monday morning, on his way to the College, he was taken so ill that he was obliged immediately to return to his room, which he did not leave again for nearly two months. In the case of young Kissam, a medical student of New York, related by the late Dr. Godman, violent symptoms supervened in less than fifteen hours, although death did not occur until the fifth day. On the other hand, the patient occasionally remains free from suffering for a comparatively long period, as in the instance of Mr. Newly, an English surgeon, who punctured himself in opening

the body of a child dead of enteritis, where no serious inconvenience was experienced until the commencement of the fourth day.

There is no question that some persons are peculiarly prone to suffer from this poison. I am acquainted with a physician who was formerly much engaged in pathological researches, who rarely opened a dead body without having a dissection boil upon his hand, thumb, or finger. Occasionally the consequences were more serious, the disease extending up the arm, along the course of the absorbents, as high as the axilla. Disordered health, hard study, general debility, mental anxiety, and other causes, no doubt, powerfully predispose to the development of the disease. A student who has for weeks inhaled the foul atmosphere of the dissecting-room, taken little exercise, and sat up late at night, eating, perhaps, withal, very heartily, will be much more likely to contract the disease, and to suffer severely, if he wound himself, than one who has taken better care of himself.

Symptoms.—The usual point of departure of this disease is the inoculated part, from which it rapidly spreads in every direction. A smarting, stinging, or burning sensation is generally the first circumstance which attracts attention. Upon looking at the part, it is found to be covered with a little whitish vesicle, perhaps hardly the size of an ordinary pin's head, filled with serum, and resting upon a hard, reddish base, extremely sensitive on pressure. When this vesicle breaks, as it usually does in twenty-four hours, a small ulcer is exposed, having a foul base, and discharging a thin, sanious fluid. The pain by this time is generally very distressing, burning, and pulsatile, depriving the patient of appetite and sleep; the sore enlarges; the swelling augments; and the surface feels exceedingly hot, tense, heavy, and numb. Generally a red line is seen extending from the seat of the inoculation along the arm to the axilla, marking the course of one of the absorbent vessels. As the poisonous influence spreads, the whole limb becomes enormously enlarged, pitting on pressure, and exhibiting a dusky, erysipelatous appearance. With this increase of swelling there is a proportionate increase of pain, which now amounts to torture; the limb feels like a mass of lead, and is completely deprived of the power of motion. In bad cases the inflammation extends to the top of the shoulder, the axilla, and even to the corresponding side of the trunk.

Such is the ordinary course of the disease; but cases occur where the order of the symptoms is reversed, the poison exploding in the axilla, and thence extending up the neck and down the side, the arm being, perhaps, almost free from inflammation, and there being no appearance, or only a very slight appearance, of disease at the seat of inoculation. The swelling, which sometimes reaches as low as the crest of the ilium, is, at first, of a doughy character, and of a pale pinkish hue; but it soon becomes hard, and assumes the peculiar erysipelatous blush already described as belonging to the more common variety. The pain is generally exquisite from the beginning, and is sometimes of itself sufficient to crush the system, before sufficient time has elapsed for the formation of the characteristic pustule. Such cases, which are always fraught with danger, have been known to terminate fatally in a few days.

It is not every case of inoculated dissection wound that gives rise to general symptoms; on the contrary, in the great majority of instances, the affection is altogether of a local character, being confined to the immediate neighborhood of the original injury, diffused over the hand and wrist, or, it may be, limited to a few absorbent vessels, as seen by the red lines extending up the limb. Under such circumstances the patient may feel a little unwell, have some headache, and want of appetite, or suffer from chilliness and aching of the limbs, but there will be no serious disturbance of the general health. This will, however, be sure to occur, if the virus has gained full admission into the system, the symptoms showing themselves, on an average, in from twelve to twenty-four hours. The patient, at first, has merely a feeling of depression, or faintness, with a sense of chilliness, pain in the head, and slight derangement of the digestive organs. This prodroma is speedily succeeded by violent rigors, alternating with flushes of heat, nausea and vomiting, excessive restlessness, intense thirst, an increase of cephalalgia, a haggard, wo-begone state of the countenance, and indescribable despondency. The tongue is coated, the respiration hurried, the skin dry and hot, and the pulse sharp and frequent, but feeble. The bowels are either constipated, or, as more frequently happens, harassed with diarrhœa.

The disease, in its worst forms, soon reaches its crisis, the system rapidly falling into a typhoid state. During this downward course the symptoms above described become more and more marked; the tongue is dry and brown; the pulse quick and tremulous; the countenance sallow and withered; the skin yellow and covered with clammy sweat; and the suffering indescribably severe. Delirium always sets in at an early period, and is a prominent symptom throughout. Death occurs in a few days to a few weeks, according as there is overwhelming exhaustion, or depression from gangrene and metastatic abscesses.

The appearances discovered on *dissection* are variable. When the case has run its course very rapidly, the internal organs may, apparently, be entirely free from disease, or there may be evidence of slight effusion into the chest, with an engorged condition of the lungs, the affected structures themselves being somewhat infiltrated with serum and lymph. Under opposite circumstances, there will generally be marks of inflammation of the arachnoid membrane, of the pleura, lungs, and peritoneum, with, perhaps, deposits of pus in the larger joints, among the muscles, and in the subcutaneous cellular tissue. The parts more immediately involved in the morbid action will be found to be enormously distended with the ordinary products of inflammation, highly softened at some points and greatly indurated at others, with here and there an abscess, and, perhaps, a gangrenous spot.

The *prognosis* of this affection may be deduced, in some degree, from the preceding remarks. When the disease is strictly local, much suffering may be the consequence, but ultimate recovery will be certain, the part immediately affected becoming, perhaps, withered and completely useless, as often happens when the lesion is seated in a finger.

In the very worst cases death may occur in less than forty-eight hours, from the empoisoned condition apparently of the nervous system, with little or no evidence whatever of local disease. In another class of cases, also very bad, the patient may live five or six days, and then perish from the violence of the resulting inflammation; or he may linger on for weeks and months, abscess after abscess forming in the limb, on the side, or in other regions of the body, and finally die from constitutional irritation; or, lastly, he may, after having been for a long time on the very brink of the grave, struggle through the disease, and in the end make a good recovery, or he may remain permanently weak, and crippled in some internal organ.

Some persons are a long while in recovering from apparently very trifling accidents of this kind, depending either upon some idiosyncrasy, or upon some derangement of the general health. I myself formerly suffered a great deal in this way. On one occasion my thumb, which had been accidentally pricked in examining the body of a woman dead of phthisis, remained sore for fifteen months; and a former colleague of mine, Professor Rogers, of Louisville, once had an affection of this kind upon one of his fingers which troubled him for upwards of three years. When the disease is thus protracted, the probability is that disorder of the digestive organs is essentially concerned in nursing its latent embers.

Treatment.—The treatment is preventive and curative. As soon as a wound of this kind has been received the part must be most thoroughly washed, first with warm water and castile soap, and then by holding it under a stream of cold water, suction being at the same time performed with the mouth. If the wound be very small, or valvular, the best plan will be to dilate it, as a preliminary step, in order to facilitate the extraction of the poison. Whatever method be adopted, the operation is completed by effectual cauterization with the acid nitrate of mercury, inserted into the wound by means of a small pointed stick of wood. In the absence of this article, which I prefer to everything else for the purpose, use may be made of nitrate of silver, butter of antimony, nitric, muriatic, or sulphuric acid, or a saturated solution of equal parts of alum and nitre. Persons who are in the habit of suffering from dissection wounds should always employ some precautionary measures in examining dead bodies, such as anointing the hands well with pomatum, lard, tallow, or simple cerate, and even wearing thin leather gloves, any fluids that may be present being previously removed by an assistant. Fortunately, since the introduction of zinc injections now in such common use in our schools, suffering, in any form, from dissection wounds is much less common than formerly. In the Jefferson Medical College, no case of a serious character has occurred since this article first began to be used by Dr. Wallace, the able demonstrator of anatomy. The pupils of the other schools of this city have, I believe, been equally exempt.

If the case has been neglected, or if, in spite of the precautions here mentioned, a vesicle forms at the site of the wound, this should be at once opened by a free incision, when, bleeding having been encouraged by immersion in warm water, the part should be thoroughly

cauterized with the nitrate of silver, or wet with the dilute tincture of iodine, an ectropic effect being still hoped for, though not likely to be attained. Warm water-dressing with laudanum is then applied, and the patient must take a brisk cathartic, keep quiet, and live light, watching the progress of events. If the disease extend, the indications will be to limit its action as much as possible, and to sustain the system under the approaching struggle. In view of the inevitable typhoid tendency, all exhausting remedies must be carefully withheld, especially the lancet and active purgation. If nausea and vomiting are present, a mustard and salt emetic, or an emetic of ipecacuanha is administered, and the bowels and secretions are regulated by mercurial laxatives, aided, if there be high fever, by tepid sponging of the surface, and the use of the neutral mixture. To relieve the excessive pain and restlessness, opium must be given in large and sustained doses, united, if there is much dryness of skin, with a little antimony or ipecacuanha. The distressing headache which so often attends the disease must be treated with cold applications to the scalp, the hot foot-bath, and the exclusion of light and noise; but anodynes will, in general, afford more ease than anything else. If inflammation of the arachnoid is threatened, a few leeches may be applied to the temple, or a blister to the nape of the neck. The moment typhoid symptoms appear, the proper remedies will be milk punch, quinine, iron, and ammonia. In the more terrible forms of the disease, commencing with violent pain in the axilla, side, and shoulder, these means should be used at once, in large quantity, especially the brandy, with the hope of neutralizing the poison, and thus arresting its zymotic tendency. Although we know nothing of the nature of this poison, yet it is not at all improbable, judging from the good effects which are said to attend the employment of alcohol in the treatment of snake bite, that brandy and other spirituous liquors might be of great service in dissection wounds. The suggestion, at any rate, seems to me to be worthy of attention. Their beneficial effects might possibly be increased by the free use of carbonate of ammonia; certainly by that of anodynes.

As it respects the parts more immediately concerned in the disease, the best remedies, after the first ten or twelve hours, will be the warm water-dressing, medicated with laudanum and Goulard's extract, acetate of lead, or hydrochlorate of ammonia, preceded and accompanied by the dilute tincture of iodine. Lint wet with oil of turpentine and laudanum sometimes affords great comfort. Blisters and nitrate of silver are objectionable, their vesicating effects interfering with other applications. Leeches are occasionally productive of great relief, but they are not to be used, except in very robust subjects, and in the early stage of the affection. When there is much œdema, the pressure of the bandage will be useful. Tension is relieved, and matter evacuated, by free and timely incisions.

Covering the parts thickly with strong mercurial ointment, along the whole track of the inflamed lymphatic vessels, is sometimes useful in arresting the spread of the morbid action, and promoting the absorption of effused fluids. Dr. E. Wallace speaks in terms of high com-

mendation of this mode of treatment, and the facts which he has communicated to me warrant me in saying that it is worthy of fair trial in the early stages of every case of the disease likely to come under the notice of the practitioner.

The secondary effects of this class of injuries are removed by change of air, attention to the secretions, tonics, iodide of potassium, and cod-liver oil. In obstinate cases, a mild course of mercury may be necessary. The most eligible topical remedies are evaporating spirituous lotions, or lotions of acetate of lead, Goulard's extract, or hydrochlorate of ammonia. Sometimes a deep and free incision will afford more prompt relief than anything else.

b.—*Malignant Pustule.*

This is a disease of the cutaneous and cellular tissues, commencing in the form of a little vesicle, and rapidly terminating in gangrene, its cause being a septic virus generated by horned cattle laboring under murrain. The French surgeons usually describe it under the name of charbon, and in many parts of Europe it is vulgarly known by the term Persian fire, or malignant pimple, the former having reference to the horrible pain which attends it, the latter to its destructive tendency.

The disease is met with in various sections of the Union, though it appears to be less common here than in Europe. Cases of it have occasionally been noticed in this city and its vicinity, and I have myself seen it in Kentucky, where, as well as in Ohio, Illinois, Tennessee, Mississippi, and Louisiana, murrain sometimes prevails as an epidemic. In the latter State it caused great havoc, in the summer of 1851, among the stock of the parishes of St. Mary and Vermilion, carrying off an immense number of cattle, as well as a considerable number of horses and mules, among the latter of which it first broke out. Hogs and dogs that ate of the carcasses took the distemper, and soon died of it. Several cases occurred in which the disease was communicated to the human subject by the green carrion-fly. During my residence at Louisville four cases of the malady came under my observation, all having been contracted in flaying and eviscerating cows dead of murrain. Three of the cases were males.

In Europe, malignant pustule has hitherto been chiefly observed on the continent, particularly in France, Holland, Switzerland, and Germany. The inhabitants of Great Britain appear to be nearly exempt from it; at least we may so infer from the fact that hardly any allusion is made to the disease in any of their works. In France it is said to be very common in Lorraine, Frenche-Comté, Burgundy, Provence, Lyonnais, and some of the other southern regions, although no part is wholly exempt from it. It appears to be rare at Paris, but frequent at Marseilles, showing that locality is favorable to its production.

The disease is most common upon the hands and face, because these parts, being habitually exposed, are most liable to inoculation. Persons who work among hides, both green and dry, tanners, butchers, shepherds, blacksmiths, and veterinary surgeons, are most liable to its attacks. It is often contracted by common people in flaying and evis-

cerating animals dead of murrain. It has also occurred from introducing the hand into the rectum and vagina of a cow laboring under putrid fever. Cases have been observed where the virus was conveyed by insects from the diseased brute to man. I have already alluded to the fact that it may be communicated by the green carrion-fly. It would seem that certain parts of an animal, as the hair and wool, retain the poisonous matter for a long time, and even after they have been most thoroughly washed and cleansed. Dr. Bourgeois refers to the case of a man in which the disease was apparently produced by picking the horse-hair taken out of an old sofa. A very common way in which it is contracted is by handling dry hides. Even tanned leather is said to be capable of communicating the affection. It has been conjectured that it might be contracted by eating the flesh of brutes dead of murrain, but we know of no facts that justify such a conclusion. Whether it can be conveyed from one human being to another, or from man to the inferior animals, is also undetermined.

What the nature of the *poison* is which produces this disease, or when, where, and how it is developed, is a question which we have no means of solving. It appears to be of a zymotic character, like the virus of smallpox and chancre, and to be generated by most of our domestic animals, especially cattle dead of murrain, its occurrence being less frequent in the horse, mule, ass, and sheep. From certain facts that have transpired, it is not improbable that it is also generated by birds, as the hen and turkey. In a case which occurred a number of years ago in Kentucky, and of which I have collected the particulars, the disease was contracted by three persons in picking and eviscerating several buzzards with a view of extracting their oil. Both the hands and forearms of each individual were inoculated. Violent local and constitutional symptoms showed themselves by the end of the second day after the operation, the parts becoming excessively swollen and painful, and covered with numerous vesicles, which, upon bursting, exposed ill-looking ulcers, discharging a thin sanious fluid, and remaining open for many weeks. The inflammation reached up to the axilla, the glands of which were enormously enlarged, some of them finally suppurating. Recovery took place only after a long time, and after great suffering, reducing the patients to the very verge of the grave. It is difficult to say whether, in these cases, the poison was actually generated by these birds, or merely conveyed by them through their feathers. However this may be, the facts involved in them are of much interest.

Symptoms.—The period of latency of the disease is very brief, generally, perhaps, not exceeding a few hours. The first distinguishable evidence of the operation of the poison is a small reddish point, not larger than a pin's head, and the seat of a burning, itching sensation, attended with a desire to scratch. Gradually spreading in size, it is speedily followed by a little vesicle, filled with a thin, turbid serum, which, in its turn, is soon replaced by a pustule of a yellowish, brownish, or reddish color, according as it contains pure pus, or pus mixed with blood. Around the pustule is a distinct areola, not unlike that of smallpox; the part is exquisitely painful, hard, and circumscribed,

allowing itself to be raised up from the subjacent structures. Continuing to extend, it becomes gradually more and more prominent, and at length acquires a base equal to the diameter of a twenty-five cent piece, half a dollar, or even a dollar. Meanwhile the pustule bursts, revealing a foul, gangrenous ulcer, discharging a sanious, fetid, irritating fluid, sometimes quite abundant. Long before the disease has reached this crisis, the affected limb is enormously swollen, stiff, numb, heavy, and exquisitely painful, the inflammation often reaching as far as the shoulder, and seriously involving the axillary glands. The number of vesicles is variable; in one of my cases there was only a single one; in another there were two, one on the hand and the other on the forearm; in the third there were five; and in a fourth the whole arm and hand were literally covered with them, their number amounting to several hundred. When numerous, they are always proportionably small, not exceeding the diameter of a currant or a split pea.

When the disease is seated in the face, the swelling is generally so great as to give rise to the most hideous distortion, it being almost impossible to distinguish one feature from another. The eyelids are closed and distended like bladders, the lips are several times the natural thickness and hardly movable, the cheeks are enormously puffed out, and the natural line of demarcation between the jaw and neck is completely effaced. The face, in fact, looks more like a dark, shapeless mass than a human countenance. When seated here, the malady is apt to extend to the throat, causing great swelling of the palate and tonsils, attended with immense difficulty of deglutition and respiration, and sometimes followed by suffocation.

The constitutional symptoms are those, in the first instance, of general malaise, or uneasiness, with a feeling of depression and foreboding of evil. Presently high fever sets in, preceded and accompanied by rigors; and then, in a very few days, the patient sinks into a low typhoid condition, commonly attended with low muttering delirium, loss of sleep, and excessive restlessness. Death often follows in three or four days from the first manifestation of the disease; but sometimes it does not take place under a week, and in a few rare cases not before the end of a fortnight. The patient's habits and state of health at the time of the inoculation, the quantity of matter absorbed into the system, and the nature of the treatment, all, doubtless, exercise an important influence upon the issue of the case. As a general rule, however, it may be stated that few recoveries occur under any circumstances.

Dissection has hitherto thrown no light upon the nature of this disease. The internal organs, especially the lungs, are generally considerably engorged; and in a few rare instances metastatic abscesses have been found. The affected limb is usually distended with serum and lymph, the latter of which often exists in large quantity, giving the parts their characteristic hardness, and exhibiting occasionally, here and there, a greenish, gelatinous appearance. In one case I discovered several depôts of blood. If the patient survive sufficiently long, abscesses will be found in the subcutaneous cellular tissue, or evidences of purulent extravasation. The inflammation seldom extends deeply among the muscles, being apparently limited by the aponeuroses. The axillary

glands are sometimes much enlarged, softened, discolored, and infiltrated with various kinds of fluids. In the immediate neighborhood of the vesicles the parts are of extreme density, cutting with a grating noise very much like fibro-cartilage. Doubtless the veins and absorbents are implicated in the disease, but in what manner, or degree, has not been ascertained. There is usually, after death, a tendency to rapid decomposition.

Treatment.—The treatment is prophylactic and curative. As soon as it is ascertained that an individual has been inoculated, the part should be immediately cut out, after which it should be well washed with warm water, to encourage vascular disgorgement, and then still further drained by the cupping-glass, these means being followed by thorough cauterization with dilute acid nitrate of mercury or the solid nitrate of silver. Or, instead of this, the part is destroyed with the Vienna paste, or the hot iron. When early and effectual riddance has been neglected, or found impracticable, the treatment must be conducted upon general principles, by mild, soothing, and supporting measures. All sanguineous depletion, both by the lancet and leeches, active purgation, and other debilitating means are avoided, as calculated, inevitably, to hasten the fatal crisis. The secretions, always seriously deranged in this disease, are rectified by small doses of calomel, the excessive pain is allayed by full doses of morphia, and the system is sustained by the liberal use of brandy, quinine, and other stimulants. The limb, placed in an elevated position, is wrapped up in light flannel cloths, wrung out of a tepid solution of lead and opium, and if there be much tension and throbbing, early and free incisions are practised to afford vent to the effused fluids. Sometimes great comfort is experienced from the employment of an emollient cataplasm, covered with laudanum and olive oil. Fetor is allayed by the chlorides, which may also sometimes be advantageously given internally. Should convalescence take place, the cure must be promoted by nutritious drink and food, and change of air.

CHAPTER X.

EFFECTS OF INJURIES UPON THE NERVOUS SYSTEM.

Under this head may be included the more immediate effects of injuries, as nervous depression, or shock, and traumatic delirium, as it has not unaptly been termed. These effects may succeed to almost any lesion, however trivial, or complicated, their production being greatly influenced by the temperament, habits, age, and idiosyncrasy of the individual; and they deserve the most careful study, inasmuch as they are frequently followed by the worst consequences. The subject of tetanus might properly be included under the present division, but as this disease occasionally arises without any external injury, the consideration of it will be postponed until I come to speak of the affections of the nerves.

SECT. I.—PROSTRATION, COLLAPSE, OR SHOCK.

Shock may be defined to be a depression of the vital powers, induced suddenly by external injury, and essentially dependent upon a loss of innervation. It bears, in effect, the same relation to the nervous system that syncope does to the vascular; in the one case, the result is caused by a diminution of nervous fluid, in the other by a diminution of blood; in both, the consequence is more or less prostration, with perturbation of body and mind, extremely variable both as to intensity and duration. When nervous shock is severe, it may instantaneously terminate in death, as so often happens in falls and blows upon the head; more generally, however, after having continued for an indefinite period, it passes into reaction, the powers of life gradually coming up, as the different organs and the general system regain their nervous fluid. The most severe and fatal cases of shock are generally those that supervene upon direct injury to the great nervous centres, as the brain and spinal cord; no less disastrous effects occasionally succeed blows upon the epigastric region, in consequence of the violence thus inflicted upon the solar plexus of nerves. In some of these and other similar instances life is destroyed with the same rapidity as in lightning, the nervous fluid being instantaneously annihilated without the individual being rendered conscious of his doom. Such cases have their counterparts only in those frightful hemorrhages in which, a large artery, as, for example, the aorta, being divided, the patient perishes in a few seconds from loss of blood. The blood has long been known by physiologists as the vital fluid, so necessary has its integrity always

been regarded to the well-being of the system and the maintenance of healthy action. But it is certainly not the only fluid entitled to this distinction; the nervous fluid is both more subtile and more important as a life preserver. When blood flows away in a mighty and overwhelming torrent, the person dies, and life is then said to have been destroyed, as it certainly was, by the excessive sanguineous drainage. But in shock, the same effect may happen, and yet the body be literally surcharged with blood, not a single drop perhaps having been spilled in the accident causing the fatal result. Thus, of the two fluids, the nervous is, in every respect, the more important, because the more essential to life; and its disturbance is therefore a more frequent cause of death.

It would be out of place in a work on surgery to inquire into the nature of the nervous fluid, or to attempt to settle the question, so often propounded, whether there really is any fluid of this kind at all. Such an investigation belongs more properly to physiology; but there is no sensible practitioner who has not occasion daily to lament, in the exercise of his profession, his want of knowledge of the functions of the nervous system, and I feel sure that cases of disease and accident are constantly permitted to slip through our hands simply because of our forgetfulness that there is such a thing as a nervous fluid. No one is unmindful that a patient has blood, that a certain quantity of this fluid is necessary to the maintenance of health and life, and that, like the solids, it is subject to a thousand diseases, often of themselves sufficient to cause death. Unfortunately, we can never acquire any intimate knowledge of an agent so subtile as the nervous fluid; like the electric, or galvanic, which it is supposed to resemble, we can know it only by its effects.

Shock may be produced by a great variety of *causes*, some of a bodily, others of a mental character; some external, others internal. It may be purely nervous, or partly nervous and partly hemorrhagic, that is, dependent upon the conjoined loss of the nervous and sanguineous fluids. The nature and extent of shock are greatly influenced by the state of the general health at the time of the accident, the amount of the injury, the importance of the part more directly assailed, and, also, in an especial manner, by the idiosyncrasy of the individual. There are some persons, soldiers for example, of the most undoubted courage, men who would not hesitate to face the mouth of the cannon, who fall into a state of the most profound prostration from the most trifling accident; who turn pale and tremble like a leaf; whose mind is perfectly bewildered, and who are, as it were, completely stunned, from injuries so insignificant as not to affect, in the slightest degree, ordinary persons. Such an occurrence can only be explained by a reference to idiosyncrasy; and it has its counterpart in those persons who, although extremely plethoric, faint from the slightest loss of blood, or even from the mere sight of that fluid. There are other persons, on the contrary, whom hardly any accident, however severe, can shock; they are insensible to pain; their nervous system is obtuse; nothing affects them, either bodily or mentally; a severe blow may stun them, but the effect is transient; in a few minutes they are completely restored to consciousness and power. Here, again, is an example of

idiosyncrasy, a peculiarity of organization; in the former case, the individual is all nerve, all sensibility; in the latter, all blood, all muscle. But it is not only the nervous and irritable that suffer from shock; the fat and corpulent are prone to be affected by it from the slightest causes, and hence such persons seldom make good subjects for the knife; they bear the loss of blood badly, and are extremely liable to perish from erysipelas and pyemia, in consequence, as it appears to me, rather from loss of nervous fluid than from any toxic state of the blood, or blood-poisoning, properly so-called. There are some individuals whom the slightest operation will kill; touch them, and they are sure to die; they are destitute of life-power, and incapable of resisting the slightest shock. The fainting produced by the pricking of a needle and the introduction of a bougie affords a familiar illustration of shock from trivial causes.

Among the external causes of shock deserving of particular notice, on account of their crushing effects, are injuries upon the skull and spine, such as are produced by a fall or blow; gunshot, railway, steamboat, and factory wounds; dislocations and fractures; violent sprains, burns, and scalds; and some of the more severe operations, as the extirpation of enormous tumors, and the amputation of the larger limbs, even when not attended with any considerable hemorrhage.

Severe shock is frequently produced by internal causes. One of the most familiar examples of this kind is afforded in perforation of the bowel, consequent upon typhoid fever, and followed by extravasation of fecal matter. The moment this takes place, the shock is immense; if the patient had been struck severely on the head, it could not be more so; in some cases it is so overwhelming as to destroy life in a few hours. The pain which attends the passage of a gall-stone, or of a urinary concretion, is often followed by similar results; extravasation of urine may be mentioned as another example. Many a woman has perished from shock induced by severe labor; and the excessive prostration consequent upon apoplectic seizures is familiar to every practitioner.

Mental shock is often extremely severe, and is occasionally followed by the worst consequences, especially when it occurs during the progress of a severe illness, or after a severe surgical operation. Fright is perhaps the worst of the causes of mental shock. The effect of terror, in suddenly exhausting the nervous power, is well illustrated by the history of those persons, who, being sentenced to be bled to death, actually died on hearing water trickling into the basin, which they supposed to be blood issuing from their veins, after the arm had been slightly pricked, although no vessel had been opened. A sick, bed-ridden person, in danger of being burnt to death, has been known to perish from shock, brought on by excessive mental trepidation. The receipt of disagreeable news, the sudden loss of property, and, in short, violent mental emotion of almost any kind, may give rise to similar effects.

Mental and corporeal shock are often combined; and, when this is the case, it is not uncommon to see the former predominate, in a very marked degree, over the latter. The soldier on the field of battle may

suffer from bodily shock induced by a severe wound; he may feel that he is badly hurt, but still he is sanguine of recovery, and cheerfully and manfully bears up under his affliction. The surgeon examines his wound, and perceiving its grave character, informs him that it will probably cost him his life. Instantly the case assumes a different aspect; the system is overwhelmed with perturbation and excitement; the vital powers are depressed to the utmost; and death takes place perhaps several days sooner than it would otherwise have done.

The *symptoms* of shock, although extremely variable, are generally such as attend syncope from loss of blood, or concussion of the brain, which is itself only a form of nervous depression, or expenditure of the vital forces. If the accident has been slight, the effect will be that of a moderate stun, that is, the patient will experience some degree of mental confusion, look pale, and feel weak and tremulous; objects will appear dark to him, and he will probably reel, if not fall. Presently, however, especially if he lies down, reaction will take place, and in a short time he will recover both his mental and physical powers, so as to be able to converse, act, and walk in the same manner as before he was hurt. When the injury has been severe, the effect upon the nervous system will of course be proportionably greater. The patient, unable to support himself, falls to the ground, often as he does so inflicting serious violence upon his person. Consciousness, special sensation, and volition are perhaps completely abolished; the countenance is deadly pale, the respiration is slow and feeble; the pulse is small, fluttering, and, at times, altogether imperceptible; the extremities become rapidly cold; and the surface is soon bathed with an abundant clammy sweat. Gasping and sighing, with convulsive tremors, are often present, and, in general, but too clearly denote the serious character of the lesion. Not unfrequently there are involuntary discharges from the bowels, with nausea and even vomiting.

The duration of these symptoms is subject to no little diversity; at times they pass off in a few minutes, or, at farthest, in a few hours; at other times, they last for several days, and even then perhaps they do not disappear entirely, one or more hanging on for a considerably longer period. When the shock is very severe, death may occur instantaneously, or the case may linger on for some time in a state of doubt and uncertainty, with, now and then, an attempt at reaction, and at last prove fatal. Instances occasionally occur in which, after tolerably complete reaction has been established, the system sinks again into a partial state of collapse, the vital forces having evidently not sufficient stamina to maintain the action of the brain and heart. Such cases are very apt to end fatally, generally within the first twenty-four hours after their commencement.

Reaction, after shock, is denoted by a gradual, or more or less rapid resumption of the functions of the different organs, which awake, so to speak, from their slumber, and spring back again into life and happiness. One of the first evidences of this change is a return of the color of the face, with an increase of the heart's action, as indicated by the state of the pulse, which is not only stronger and fuller, but more steady and regular; the respiration is more free and open; the sur-

face becomes warmer and drier; the sphincters again obey the will; and the mind regains its self-possession and power of action. Often the first symptom of reaction, after severe shock, is vomiting, followed by complete clearance of the contents of the stomach, itself generally a favorable sign, as it is denotive of a return of muscular power.

There is a form of shock which has been called, not inaptly, insidious, as the symptoms are generally of a masked character, and are therefore well calculated to deceive both the patient and practitioner. The person, although severely injured, congratulates himself upon having made an excellent escape, and flatters himself that he is not only in no danger, but that he will soon be well; in fact, to look at him one would hardly suppose, at first sight, that there was anything serious the matter with him; the countenance appears well, the breathing is good, the pulse is but little affected, except that it is too soft and frequent, and the mind, calm and collected, possesses its wonted vigor, the patient asking and answering questions very much as in health. But a more careful examination soon serves to show that deep mischief is lurking in the system; that the machinery of life has been rudely unhinged, and the whole system profoundly shocked; in a word, that the nervous fluid has been exhausted, and that there is not enough power in the constitution to reproduce and maintain it. The skin of such persons soon assumes an icterode, or sallow, cadaverous appearance, feeling at the same time doughy and inelastic; the extremities become deadly cold; the pulse makes a desperate effort at seeming excellence, but is, at best, weak and tremulous; there is little or no pain; and the patient is altogether too composed and tranquil for the amount of injury he has sustained. The system does not seem to be conscious of what has occurred; its sensibilities are blunted, and hence it is incapable of suffering. Nature, to use the language of Hunter, does not feel the injury.

The countenance, in this form of shock, has often a peculiar melancholy expression, as if foreshadowing the fatal event; a sad smile plays upon the lip, and illumines the lower part of the face, while the upper part, on the contrary, wears a gloomy aspect, in striking contrast with the other. The forehead, as the patient looks at his attendants, especially if he has just been roused from sleep, is strongly knit and wrinkled, giving it a scowling and sinister air. As the case progresses, the brain gradually sinks into a comatose condition, the signs of prostration become more pronounced, and death finally occurs from mere exhaustion, life, under such circumstances, seldom lasting longer than three or four days.

The *treatment* of shock must be conducted with two objects in view; the first is to promote reaction, and the second to moderate supervening inflammation, for to prevent it altogether is by no means always possible.

To recover a patient from shock, he should immediately be placed recumbently, everything tight or constricting should be removed from his person, free access of cold air should be provided, cold water should be dashed upon the face, smelling bottles should be held near the nose, and sinapisms should be applied to the extremities and

precordial region. If the case be unusually severe, and apprehension is entertained for the patient's safety, stimulating injections should be thrown into the rectum, and turpentine rubbed along the spine. If deglutition is practicable, brandy and water should be given, but in attempting to convey this or any other fluid into the stomach, great care must be taken, otherwise the liquid may descend into the windpipe, and so cause strangulation. The most prudent plan, under such circumstances, is to introduce the drink with a spoon, the mouth being previously forced wide open, and a powerful effort made to excite the patient's attention by hollowing loudly into one of his ears. If he cannot swallow, no attempt should be made at compulsion, but, for the reasons just mentioned, the effort should at once be discontinued.

In the milder cases of shock, the most simple treatment will often suffice to bring about reaction; as, for example, the recumbent posture, a drink of cold water, and the use of the fan and smelling bottle. The blood and nervous fluid soon resume their wonted channels, and the vital forces rapidly regain their supremacy.

In the mental form of shock, a soothing word, or an assurance of absence of danger, will frequently go farther in promptly effecting restoration than the most powerful stimulants, steadily and regularly administered. Persons suffering from this variety of prostration are frequently much more frightened than hurt, and promptly regain their animation and self-possession when they are told that their injuries are altogether of a simple, trivial character, devoid of all danger, both present and future.

Occasionally reaction is sadly interfered with by an overloaded and oppressed stomach, as when the accident has occurred soon after a meal. In such cases, the patient often lies in a state of deadly pallor, with more or less retching, for hours, before he can shake off the oppressive burden. The indication obviously is to assist nature in her efforts at emesis, by the administration of a dose of alum, ipecacuanha, or sulphate of zinc, or, what, perhaps, is better, under such circumstances, equal parts of common salt and mustard. Serious lesion of the brain is hardly to be considered as a contra-indication to such a course, when it is recollected that the digestive powers are completely suspended, and with what difficulty reaction takes place when the stomach is oppressed by a heavy meal.

The foolish and reprehensible practice of bleeding persons laboring under the exhaustion of shock, once so common, has become completely obsolete. No surgeon should ever do anything without a reason, and it is therefore difficult to perceive what could ever have induced a procedure so contrary both to physiology and good sense. In the opinion of the vulgar, there are no cases in which it is not proper, immediately after such an accident, to draw blood from the arm; but assuredly no practitioner would yield his judgment to such an erroneous view, and perform an operation that might speedily prove destructive to his patient. Fortunately, whenever such an attempt is made by the ignorant and thoughtless charlatan, the blood generally refuses to flow, and consequently no harm is done.

The second indication is to moderate the resulting inflammation. To do this, much may be accomplished in the way of prevention, by letting on the reaction gradually; avoiding, on the one hand, the undue use of stimulants, and, on the other, cautiously interposing antiphlogistics as occasion may arise for their exhibition. Proper allowance is made for the apparent violence of the symptoms, the excitement without power; the struggle may be furious, but will in all likelihood be brief, for if the previous depression has been at all severe the flame will ere long cease of its own accord, or readily yield to the influence of very simple means, such, for instance, as sponging the surface frequently with cool or tepid water, and administering a little morphine and antimony, aided by rigid abstinence, and perfect tranquillity of mind and body. Bleeding should be practised only in young and plethoric subjects, with a tendency to serious inflammation of some important internal organ, and where, consequently, the fire is real, and not merely apparent. The opposite course often exerts a most pernicious influence upon the patient's recovery; impairing his vital powers, and preventing the system from keeping up a due supply of healthy nervous fluid, so conducive to the restoration both of the part and system. As the secretions are commonly materially deranged in all cases of severe shock, early and effectual means should be adopted for their correction and improvement; a gentle mercurial purge will often admirably fulfil the indication, and render any further use of this class of remedies unnecessary. The diet for the first few days should consist mainly of animal broths, aided, if necessary, by milk punch, or wine whey, and cautiously followed by food of a solid and more substantial character. Starvation, in cases of severe shock, is not to be thought of. Such a course cannot be too pointedly or too forcibly condemned, as it is contrary alike to sound sense and the dictates of an enlightened experience.

Anodynes are always borne well after severe shock, and should be administered early and freely, to allay vascular action and tranquillize the nervous system. The most suitable article will be morphine, or the ammoniated tincture of opium, either alone, or conjoined with valerian; the latter remedy being especially serviceable in nervous, hysterical persons. If the vital powers flag sensibly after the occurrence of reaction, recourse must be had, in addition to anodynes, to quinine, carbonate of ammonia, and brandy, liberally and diligently administered. Determination to internal organs is met by leeches and blisters.

SECT. II.—TRAUMATIC DELIRIUM.

One of the most unpleasant effects with which the surgeon has to contend in the treatment of wounds and other injuries, as well as after surgical operations, is the occurrence of delirium, at a period too, perhaps, when everything is apparently progressing in the most favorable and gratifying manner. All of a sudden, the nature of the case undergoes a remarkable change for the worse; the horizon, just a moment before perfectly calm and serene, like the summer's sky, is

almost instantly overcast by a dark, lowering cloud; the system is thrown into nervous tremors, and the mind, agitated with disagreeable forebodings, is absorbed in some peculiar fancy, in which the patient imagines himself pursued by his enemies, or annoyed by persons peeping at him through the keyhole of his door, making grimaces at him through the window, or concerting measures for his destruction. Great diversity obtains in respect to the manner in which the disease is ushered in. In some cases the symptoms are apparently of a hysterical character, the patient laughing and talking in a loud, boisterous, and incoherent manner; or perhaps indulging in unmeaning jokes about the nature of his disease, the way in which he was hurt, or the conduct which he exhibited during the operation he has undergone. In another class of cases, by no means uncommon, he is completely absorbed in his business; he harnesses his horses, hitches them to the carriage, and swears at them because they do not move to please him. In some cases, again, he is seized with a species of religious phrenzy; he prays and sings, and utters pious exclamations. Occasionally, he labors under some demoniacal delusion; he fancies that the devil has possession of him, and that he is about to be carried to the infernal regions. Finally, there are instances in which the patient is sadly annoyed by the idea that he is pursued by snakes, dogs, or rats, or that some horrible reptile is trying to creep into his throat. In short, there is no end to these delusions, which are often as ludicrous to the observer as they are distressing to the patient, to whom they are always a source of severe suffering, not less so than if they were real.

The cause of these symptoms is not always apparent. In the great majority of cases, they are produced, either directly or indirectly, by the inordinate use of alcoholic spirits, suddenly interrupted by the occurrence of a severe injury, attended, it may be, by dreadful shock, or copious hemorrhage, thus greatly increasing the susceptibility of the nervous system to external and internal impressions. It is not necessary for their development that the individual should have been a habitual drunkard; they often show themselves nearly as readily if he has merely been a free drinker without having carried the use of liquor to the extent of intoxication. On the other hand, they occasionally occur in persons of the most temperate habits, who have perhaps never used alcohol in any form, or for any purpose whatever. Dupuytren, who first called attention to this variety of the disease, has given it the name of nervous delirium, and in the paper which he has published on the subject he has reported a number of cases in which it supervened upon various kinds of injuries and operations, some of them of a very trivial character, or such as usually produce no unpleasant results of any description, the patient rapidly recovering from their effects. It cannot be doubted that, in these cases, the affection is generally of a purely nervous nature, arising from the effects of the commotion inflicted upon a delicate and highly susceptible constitution. Under such circumstances it is often mixed up with the effects of shock, rendering it difficult, if not impossible, to distinguish them accurately from each other. All practical surgeons have frequent opportunities of witnessing such cases. So far as my observa-

tion extends, I am not aware that any class of injuries is entirely exempt from the disease; sometimes the most trivial scratch, or contusion, is followed by it. Corpulent persons, who generally bear injuries and operations very badly, are particularly prone to this form of delirium. Burns and scalds, railway lesions, lacerated wounds, and compound fractures may be enumerated as among the more powerful causes of the disease. It has been thought that children are less liable to suffer from nervous delirium than adults and elderly subjects; but this is certainly not true; on the contrary, such is the susceptibility of the system at this tender age to physical and mental impressions, that the slightest accident is often sufficient to develop it. If women are less frequently affected than men, it is simply because they are less exposed to the various exciting causes of the disease. There is certainly every other reason why they should suffer quite as much as men, if indeed not more.

Nervous delirium generally comes on within the first twenty-four or forty-eight hours after the application of the exciting cause; it may last for a variable period, but rarely longer than five or six days, and may terminate either in health, or in death, according to the gravity of the injury that has produced it. Its leading symptoms are a confused, wandering, or flighty state of the mind, with excessive vigilance; incoherency of speech and manner; absence of fever; an open, moist state of the skin; and little or no excitement of the pulse. The eyes have generally a wild expression, and the patient is easily disturbed by noise and light, as well as by the presence of his attendants. The appetite is usually impaired, the bowels are costive, the urine is scanty and rather high-colored, and the feet are disposed to be cold. If the patient be spoken to, he is generally readily roused, but soon lapses into his former condition.

Nervous delirium, properly so called, is easily distinguished from delirium tremens by the absence of tremors, which form such a striking feature in the latter disease as to be characteristic. In delirium tremens the limbs are in a constant trembling condition; the symptom comes on early in the attack, and always lasts until the effects of the disease are nearly worn off. When the delirium is fully developed, the hands and fingers are incessantly in motion, the patient carrying them to his mouth, face, and head, as if he were desirous of swallowing something, or removing some imaginary object from his person. The countenance is usually flushed, the eyes are deeply injected, the pulse is small, frequent, and quick, and the mind is roused with difficulty. Added to these circumstances is the history of the case, which generally affords valuable, if not conclusive, information respecting the patient's habits prior to his attack.

Delirium tremens, the result of alcoholic stimulation, is an extremely common occurrence after all severe operations and injuries, and is one of the most serious causes of their mortality. Hence operations should never, if possible, be performed upon this class of persons so long as they can be put off, or without due preparation of the system; special care should also be taken to avoid shock and loss of blood, as these are two of the most powerful predisposing causes of the disease.

It is well known that persons addicted to the immoderate use of opium and tobacco are liable to suffer from a peculiar form of nervous delirium after severe injuries and operations, characterized by excessive wakefulness, and a sense of indescribable wretchedness, with a bewildered and confused state of the mind, from which it is sometimes extremely difficult to rouse them, so as to induce them to take their necessary food and medicine. It is not improbable that the excessive use of coffee and tea may, in persons of a very nervous, excitable temperament, produce similar effects.

In general, as was previously intimated, traumatic delirium usually sets in at an early period after the application of the external injury that provokes it; sometimes, however, the patient, perhaps contrary to expectation, goes on exceedingly well for some considerable time, happily surmounting the primary effects, but suffering severely from the secondary, the consequence commonly of profuse, unhealthy, and exhausting suppuration. Again, instances occur in which he may have several attacks of this nervous suffering, with a variable interval of from several days to several weeks, during which the mind may be perfectly clear and tranquil, the patient bearing up manfully under his disorders, sanguinely and fully anticipating none other than the most favorable termination.

Traumatic delirium, however induced, or in whatever manner it may present itself, is often extremely difficult of management. In its worst forms, the mind is frequently so completely disordered as to render confinement of the patient with the strait waistcoat an indispensable item of the treatment. This is the more necessary when, as sometimes happens, the patient is disposed to tear off the dressings from his wounds, to commit suicide, or to hurt his neighbors and nurses. There is a remarkable circumstance which has been noticed by all practitioners in this class of persons. I allude to their utter indifference to pain. So great is this, in many instances, that they will not only uncover their wounds, but absolutely take a sort of pleasure in handling and picking them. Dupuytren refers to the case of an old man who, having been operated upon for strangulated hernia, tore away the dressings from his groin, and composedly squeezed his bowels, his friends all the while thinking he was getting on most admirably, such was his calm and quiet demeanor as he lay in bed.

One of the most important indications, then, is to set a careful watch over the patient, in order that he may not do any harm either to himself or others; in wounds and fractures the most perfect quietude is generally necessary, and the greatest pains should therefore be taken to secure it to the fullest extent, for whatever has a tendency to disturb and fret the parts will be sure to act as a cause of additional excitement. Moral force alone will be of no avail; the patient can neither reason correctly himself, nor comprehend the reasoning of those about him. Hence if medicine does not promptly effect the object, the only resource is the strait jacket, applied of course with proper care, so that while, on the one hand, it shall not be so loose as to frustrate the intention of its use, it shall not, on the other, be so tight as to occasion injurious constriction; a circumstance which, although a matter of paramount

importance, is not always, as I well know from experience, as scrupulously attended to as it should be by nurses and practitioners.

The next indication is to tranquillize the nervous system, and induce sleep, or, in other words, to get rid of the redundant excitement. To fulfil this indication, recourse must be had to anodynes, administered in such doses as shall most promptly and effectually bring about the desired result. The patient must sleep before he can obtain relief; the early interposition therefore of suitable treatment is a matter of primary importance, attacking and routing the disease, as it were, in its very incipiency, ere yet it has taken firm hold of the system. The best remedy will be found to be opium, either in the form of morphia or of the acetated tincture, given in full and sustained doses, in combination with a sufficiency of tartar emetic to prevent vascular excitement and promote perspiration. Solid opium is objectionable, as it takes a long time to dissolve in the stomach, and often excites instead of tranquillizing the nervous system. Tartar emetic will always be found to be a most valuable adjuvant. In the milder cases, the disease frequently promptly yields under the influence of a small quantity of laudanum, as from fifteen to twenty-five drops, in half an ounce of camphor-water and a drachm of the compound tincture of cardamon, repeated every two or three hours. Dupuytren was in the habit of employing laudanum as an injection in this disease, giving from ten to twenty drops with a small quantity of water, and frequently repeating the dose, until he succeeded in accomplishing his purpose. He asserts that the medicine thus administered often exerts a much more prompt and happy effect than when given by the mouth; and the result of my own experience amply corroborates the truth of the statement. As a preliminary measure, the rectum should be well cleared out with an ordinary enema.

When opium and its preparations cannot be borne, an excellent substitute will occasionally be found in hyoscyamus, lupulin, aconite, belladonna, and Indian hemp; aided by the cool shower-bath, followed by dry frictions, or, what will generally answer quite as well, and be more convenient, sponging the surface freely and repeatedly with tepid, cool, or cold water. When the delirium is furious, leeches should be applied to the temples, or a large blister to the nape of the neck, and cold to the scalp, previously divested of hair. As a temporary expedient, and an auxiliary for allaying the violence of the spasms, the judicious inhalation of chloroform will be of service. General bleeding will rarely be proper in any case, whether of nervous delirium or delirium tremens. In nervous, hysterical females, the free use of assafœtida and of valerianate of ammonia often answers better than almost anything else.

When the patient has been a habitual drunkard, or when the delirium can be distinctly traced to the effects of the sudden withdrawal of alcoholic stimulation, the dictates of common sense, not less than the results of sound experience, indicate the propriety of a resumption of the accustomed drink, or a resort to an appropriate substitute. Much judgment will of course be necessary under such circumstances, lest the remedy be carried too far, causing thereby additional excitement and vigilance instead of composure and refreshing sleep.

CHAPTER XI.

SYPHILIS.

SECT. I.—GENERAL CONSIDERATIONS.

The term syphilis is applied to a class of diseases which, commencing in the genital organs in the form of a sore of a specific character, may, and often do, invade the lymphatic ganglions of the groin, the cutaneous and mucous tissues, and finally also the bones, cartilages, and fibrous membranes, leaving upon each and all of them, as well as upon the system at large, a peculiar and distinctive impress. These different parts, however, do not all suffer at one and the same time; on the contrary, it would seem to be necessary that the poison upon which the infection depends should lie for a certain period in the tissues into which it has been deposited in order to enable it to prepare itself for further action. Thus, in the first instance, the operation of the poison is strictly local, the sphere of its influence being limited to the genital organs, or to these organs and the lymphatic ganglions of the groin. After having lingered here for some time, varying, on an average, from four to six weeks, the cutaneous and mucous surfaces begin to suffer; and at a still later period, that is, from six to eighteen months, the bones, cartilages, and fibrous textures are attacked. In this manner are produced three distinct groups of syphilis, known, respectively, as primary, secondary, and tertiary, depending upon the peculiar modifications of the specific poison to which the malady owes its origin.

It is not my intention here to enter into an account of the history of the origin of syphilis; such an undertaking, besides involving an immense amount of research—ethnological, literary, and biblical—would be entirely out of place in a treatise of this description, exclusively limited as it is intended to be to the practical details of surgery. Such of my readers as may feel an interest in the subject will find all the information they may desire in the various monographs that have, from time to time, been published in relation to it, and the number of which is by no means inconsiderable. I may remark, however, that, in my opinion, it is great folly to regard the disease as of modern origin. If the records of antiquity could be fully explored, it cannot be doubted that we should discover the most satisfactory and irrefragable evidence of the existence of syphilis in the most remote periods of society, now aggravated, and now kept in abeyance, according to the habits and morals of the various races of mankind, and the nature of the climate of the countries in which they dwelled. If the history of the inner life

of Sodom and Gomorrah could be laid open to our scrutiny, it would furnish a page to the history of prostitution as loathsome and disgusting as any afforded by the vilest and most depraved cities of the present day, either in the Old World or in the New.

Syphilis is peculiar to man. Numerous experiments have been performed, by inoculation, upon almost all the domesticated animals, but in no instance whatever has the poison produced any specific effect. The little puncture made with the lancet in the operation became temporarily inflamed, but the impression soon passed off, and the parts rapidly recovered their natural condition. If, in the monkey, the inoculated surface assumed somewhat more of the appearance of a chancre than in the other classes of animals subjected to trial, it was, nevertheless, not characteristic, and it is certain that no case has ever been reported where the insertion of the matter was followed by constitutional symptoms.

The disease never arises spontaneously, but is always the result of inoculation with a peculiar *poison*, known as the poison of syphilis or of chancre. Of the precise nature of this poison we have no knowledge; we only know it by its properties, or by the effects which it is capable of producing upon the economy when brought in contact with it under circumstances favorable to its development. Thus, observation and experiment have shown that it always produces a disease similar to itself, the resulting sore or ulcer secreting a virus, in every respect identical with that which furnished it in the first instance. Like the poison of smallpox, it is a peculiar poison, capable of reproducing itself, and of multiplying itself by zymosis. The smallest, inconceivable atom, brought in contact with an appropriate surface, will speedily develop a disease which, if permitted to progress, may occasion the most horrible consequences, both local and constitutional, and so contaminate the solids and fluids as to render it transmissible from the parent to the offspring. As a little yeast may impregnate a large mass of dough, and cause a ferment that shall affect every particle of gluten entering into its composition, so a little syphilitic virus, so minute as to be utterly inappreciable by our senses, may affect the whole system, and poison every avenue of life and health. Zymosis having fairly commenced, it is impossible, in any case, unless proper means be adopted to counteract it, to say when it may cease, or what may be its effects.

The pus which contains the syphilitic virus, and which therefore serves as a vehicle for its propagation, does not, so far as can be ascertained, differ from pus supplied by ordinary inflammation, either in its physical, chemical, or microscopical characters. Thus, it may be thick and yellowish, serous, ichorous, or plastic; bland or acrid; acid, alkaline, or neutral; pure, or mixed with adventitious matter; and, lastly, perhaps, even animalcular, although this point is not fully settled. The specific property of the virus is not destroyed for a number of weeks, if the pus with which it is combined is preserved in a well-corked vial; resembling, in this respect, the virus of vaccinia and variola. It is rendered inert, however, by chemical agents and also by gangrene of the tissues which have been inoculated with it.

The infecting virus does not seem to have any particular predilection for age, sex, temperament, or occupation; all are alike liable to be affected by it. Previous disease does not prevent its action. It produces its peculiar impression most readily when applied to a clean ulcerated surface, an abrasion, or a recent wound; but inoculation may take place independently of these circumstances, simply from the introduction of the virus into a mucous follicle, which thus serves to entangle and retain it until its structure is brought thoroughly under its influence. When the part to which the virus is applied is perfectly healthy, several days may elapse before it becomes impregnated; or it may escape even entirely, the matter which contains it either not being able to penetrate its surface, or, being wiped off before absorption is effected. For the same reason a person so situated may communicate the poison to another with the effect of producing a chancre, while he himself experiences no ill effects. Such a result not unfrequently happens in women, in consequence of the matter of syphilis lodging in the folds of the mucous membrane of the vagina, where it is afterwards transferred to the virile organ in the act of copulation.

The syphilitic virus may be transmitted in various ways; first, by sexual intercourse, which is by far the most common; secondly, by unnatural connection, giving rise to chancres of the anus and perineum; thirdly, by the body and bedclothes of the person; fourthly, by surgical instruments and dressings; fifthly, by chamber-pots and water-closets; and sixthly, by the fingers of the affected individual. In this manner a patient may inoculate his lips, nose, eyelids, or any abraded, raw, or open surface upon any portion of the body. In this way, too, accoucheurs sometimes inoculate their fingers in examining women laboring under chancre of the vulva, vagina, or uterus.

It is still a mooted point whether the virus of syphilis begins to act the moment it comes in contact with the living tissues, or whether, after having been absorbed by them, it remains there in a state of latency, as is supposed by some to be the case in inoculation in hydrophobia. Without attempting to decide this question, for which our data are perhaps still insufficient, it is reasonable to infer that the effects vary, in different cases and under different circumstances, according to the structure of the inoculated surface, the natural susceptibility of the part, the purity and quantity of the poison, and the degree of the resulting inflammation. It is well known that a tolerably distinct chancre is sometimes formed within the first twenty-four hours after an impure connection, whereas at other times this result does not follow under a week. The average period may be stated at from three to six days. My opinion is that the actual latency of the virus is very short, and that, like other zymotic poisons, it begins to act, although imperceptibly to us, within a very brief space after it has been inserted. The probability of this conclusion is strengthened by what occurs in artificial inoculation, an operation which is usually performed upon the skin of the inner surface of the thigh.

SECT. II.—PRIMARY SYPHILIS.

Primary syphilis consists, as already stated, of chancre and bubo; that is, of an ulcer of the genital organs, and of a swelling of the lymphatic ganglions of the groin, often eventuating in suppuration and other bad effects. So long as the disease is limited to these structures it is of a strictly local character; but when it passes beyond them, so as to affect the system, it becomes constitutional.

1. CHANCRE.

If a small quantity of matter be taken from the surface of an ulcerating chancre, and inserted with the point of a lancet into the substance of the skin, just beneath the epidermis, the earliest effect, manifesting itself within the first twenty-four hours, will be a little reddish speck, looking very much like a flea-bite, and denotive of very slight inflammation, such, for example, as might be supposed to result from any little puncture independently of the operation of any specific virus. During the next twenty-four hours, the part exhibits the appearance of a minute papula, or little swelling, somewhat elevated above the surrounding level, and encircled by a faint narrow rose-colored areola. From the third day to the fourth the papula assumes the form of a vesicle, the epidermis being raised by a drop of whitish, pearl-colored serosity; the inflammation is more considerable, and the areola is of larger size and of a deeper hue. At the end of this period the vesicle is transformed into a pustule; that is, the inoculated part becomes filled with pus, its centre is gradually depressed, and the areola acquires its most distinctive features. From the fifth to the sixth day the structures immediately around the seat of the disease undergo a remarkable change; hitherto they had been quite soft, or, at most, only somewhat œdematous, but now they are observed to become indurated from the deposition of plastic matter, and to feel, when pressed between the thumb and finger, like a mass of fibro-cartilage, or tolerably firm cheese, the sensation partaking at the same time of an elastic nature. Having assumed this character, the sore is possessed of the requisite properties for secreting infecting matter, of which, up to this moment, it was destitute. At the expiration of the sixth day, the pustule begins to turn dark, its contents solidify, and a firm, thick scab forms, composed of several strata, and having the shape of a truncated cone, with a depressed apex. Should the scab now fall off, or be accidentally removed, a large, deep ulcer will be exposed, having an excavated appearance, as if it had been scooped out with a punch, its edges being steep and slightly ragged, its bottom incrusted with a layer of grayish, aplastic lymph, and its base hard, firm, and slightly elastic like fibro-cartilage. The discharge is generally of a thin, sanious, or ichorous nature, without any of the properties whatever of laudable or healthy pus. The ulcer thus formed constitutes what is termed an indurated chancre, or, from the faculty it possesses of contaminating the system, the infecting chancre. It is also not un-

frequently called the Hunterian chancre, from the fact that it was first accurately described by Mr. John Hunter in his treatise on the venereal disease. From what has been said, it will be perceived that, although the poison doubtless begins to act at an early period after inoculation, yet it requires some time before it can produce a true syphilitic sore, and that the local disease itself consists of several well-marked stages, running, however, gradually into each other; the first distinct evidence of its presence being a papula, the second a vesicle, and the third a pustule, followed by a hardened base and an excavated ulcer, bathed with infecting matter, which is capable of contaminating the constitution, fluids as well as solids.

Although a chancre may occur on any part of the body, yet as it is by far most common on the genital organs, it is here that it has been studied with the greatest care and attention. Its most common sites are the head of the penis and prepuce, the vulva, vagina, and uterus. The disease may also attack the urethra in both sexes, especially in the male, although the occurrence is very uncommon. Any portion of the head and foreskin of the penis may be affected, but of the former the corona, or, rather, the gutter just behind the corona, and the surface on each side of the frenum are most liable to be involved, from the circumstance that these parts are particularly apt to retain the infecting matter; for the same reason the free extremity of the prepuce is very prone to suffer. A severe chancre occasionally forms on the body or root of the penis. In the female the disease sometimes occurs on the perineum, on the outer surface of the labium, and around the anus.

A chancre upon the mucous surface of the genital organs does not always pass through the same regular stages as a chancre upon the skin from artificial inoculation. On the contrary, it frequently begins as an ulcer, in consequence of the matter having been brought in direct contact with an abraded surface, or a scratch, and in this case the evolution of the disease is always peculiarly rapid and well-marked. At other times, again, it commences as a boil or an abscess. This form is most common when the inoculation has taken place from the matter having insinuated itself into the orifice of a mucous follicle. Under such circumstances, the gland swells and becomes softened, and is soon after destroyed by ulcerative action. Moreover, it is important to remember that the vesicular and pustular stages above described may have passed by unnoticed, and that, consequently, when the sore is first inspected, it may possess all the characters of a well-defined chancre. No general symptoms precede or usher in the local disease, whatever may be the form in which it begins; all that the patient experiences is a slight sensation of heat, some itching, and an increase of the sensibility of the part which is about to become the seat of the infection.

Chancre presents itself under two *varieties* of form, the indurated and the non-indurated or soft, all other distinctions being now abandoned, on the ground that, whatever differences of appearance the sore may exhibit, they are solely and entirely of an accidental character, and therefore altogether independent of the nature of the syphilitic virus. It is impossible, in the actual state of the science, to determine

why one person should have a hard chancre and another a soft chancre. In the adjudication of such a question it will not do to invoke the existence of a corresponding number of poisons; to do so would be to destroy the unity of the disease, and to invest the subject with inextricable confusion. The most philosophical course, in the absence of facts, is to assume that there is really only one virus, but that this virus is capable of being so modified in its character, by local and constitutional causes, or by internal and extrinsic circumstances, as to produce effects apparently the very opposite of each other in different individuals. How else can we explain the occurrence of indurated and non-indurated sores upon the genital organs? The laws of disease have their irregularities and anomalies not less than the laws of health; exceptions meet us everywhere, and it would indeed be very singular if they should be altogether wanting in syphilitic affections. In the production of the two varieties of chancre here alluded to, some powerful modifying circumstances must be in operation, shaping, influencing, and controlling the result. Smallpox, scarlatina, measles, and other eruptive diseases are subject to remarkable departures from the natural standard, and yet no pathologist of sense would for an instant suppose that every new feature exhibited by these affections was indicative of the existence of a new poison. The modifying cause, whatever it be, may exist in the inoculated structures, in the peculiar nature of the pus containing the specific virus, in the specific virus itself, or in the state of the constitution, or in all these circumstances combined.

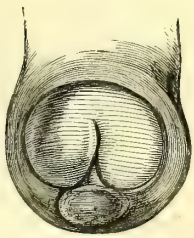
M. Ricord has recently published some very singular statements in regard to the peculiarities of these two varieties of chancre, which, if they shall be ultimately verified by the observation of others, would almost necessarily lead to the conclusion of the existence of two separate and distinct varieties of syphilitic poison. Thus, he positively affirms, on the strength of a large clinical experience, that the indurated ulcer alone is an infecting ulcer, that is, a chancre capable of secreting a fluid which, if conveyed into the system, is capable of contaminating the solids and fluids in such a manner, and to such an extent, as to give rise to secondary and tertiary accidents. The non-indurated chancre, on the contrary, he regards as a purely local affection, often troublesome, it is true, but always free from the risk of invading the constitution in anywise whatever. My observations would lead me to infer that, while there really are two varieties of chancre, the indurated and the soft, as described by the French syphilographer, they do not by any means possess the properties which he ascribes to them. The hard chancre is unquestionably most frequently followed by constitutional symptoms, but to maintain that it is so exclusively is what, I am sure, no experienced practitioner will admit. So far from giving my adhesion to such a doctrine, I have had the most unequivocal evidence, in numerous instances, of the infecting properties of the soft chancre. Indeed, I am satisfied that some of the very worst cases of secondary and tertiary syphilis that I have ever been called upon to treat have been cases of this description; originating generally in very small sores upon the head of the penis or prepuce, perfectly soft in their consistence, very superficial, manifesting no disposition to spread, and soon completely

disappearing. Such chancres not unfrequently exist without the knowledge of the patient, their discovery being, perhaps, altogether accidental. It is doubtless this form of ulcer which has given rise to the absurd notion, not yet entirely exploded, of the possibility of the formation of bubo without the precedence or concomitance of chancre.

The characters of the indurated chancre may be deduced from the account already given of artificial inoculation of the skin, which affords its best type. In order, however, to contrast its features with those of the soft chancre, it may be well here to reproduce the description of the principal phenomena which mark its progress.

The *indurated chancre* (fig. 65) is usually rounded or somewhat oval, and from the diameter of a split pea to that of a five cent piece. Its surface is hollow, as if scooped out, and incrusted with a layer of lymph, of a dirty grayish color, and very firmly adherent. The edges of the ulcer are hard, slightly elevated, and inclined a little slopingly from within outwards. The base is well-defined and remarkably hard, feeling, if pressed between the thumb and finger, like a button of fibro-cartilage, or, to employ the comparison of Benjamin Bell, like a split pea, set in the tissues immediately around the chancre. The induration begins to form about the end of the fifth day, and generally attains its maximum by the end of the tenth or twelfth. The amount of induration of the base varies; in general, it will be found to be less on the prepuce than on the head of the penis, the nature of the affected tissues doubtless influencing the result; and it usually lasts some time after the chancre is completely cicatrized, a circumstance, as will appear by and by, of great practical moment.

Fig. 65.



Indurated chancre.

The indurated chancre is generally solitary; it has no distinct areola; its march is indolent; and it secretes a thin, serous, sanguinolent, or ichorous fluid, small in quantity, and difficult of inoculation. Hence, unless the matter come in contact with a raw surface, or a surface well adapted for its absorption, a second chancre seldom arises during the progress of the primary one. Another feature of the indurated chancre is its extreme liability to infect the lymphatic ganglions and the general system, few persons, if any, escaping contamination after it has reached maturity.

The *soft chancre*, also generally of a rounded form, but less regularly so than the hard, is much more common than the latter, and is often multiple, from three to six or eight occasionally occurring in the same subject. They are particularly apt to develop themselves at the free margin of the prepuce, and at, or just behind, the corona of the penis. Several often arise simultaneously, and others are liable to form during their progress from fresh inoculation, or the mere contact of their own secretion with the surrounding parts. The surface of the soft chancre is superficial, flat, uneven, and coated with a grayish, whitish, or dirty drab-colored deposit. In some cases it is found to have a worm-eaten appearance. Its edges, when seated on the head of the penis,

are steep and abrupt, as if made with a punch, but on the prepuce they are generally overhanging, sloping or shelving, extremely ragged, and less closely identified than those of the indurated chancre with the neighboring structures. The base of the chancre is entirely free from induration. The only exception to this is where irritating applications have been used, causing an increase of inflammation with a deposit of plastic matter.

The soft chancre generally manifests a disposition to spread, and, in persons of a broken constitution, often takes on phagedenic action. It secretes an abundance of purulent fluid, which is highly infectious, and therefore readily inoculable, thus accounting, as already stated, for the multiplication of ulcers during the progress of the disease, one sore being added to another in consequence of the dissemination of the matter over the surrounding surface. The soft chancre is frequently, but not generally, followed by bubo, the disease being usually limited to one ganglion, which, becoming inflamed and swollen, rapidly suppurates, and, in time, forms a large ulcer, the matter, like that of the chancre to which the bubo owes its origin, being at first inoculable, and capable, in turn, of producing a soft chancre. Finally, the soft chancre often affects the system, giving rise to secondary and tertiary symptoms; attacks of this kind, however, are less common than in the indurated variety, though the effects are frequently not less deplorable.

The period during which a chancre retains its specific character varies. Occasionally, though rarely, it loses its infecting properties in ten days or a fortnight. The average time, however, is much longer; and, on the other hand, an instance sometimes occurs where the specific poison continues to be secreted for many consecutive months. As a general rule, it may be stated that no patient is safe as long as the ulcer is not in a granulating condition. The observations of Ricord tend to show that one attack of indurated chancre effectually protects both the part and system against a second attack, the syphilitic poison thus resembling, in its habits, the poison of smallpox; the soft chancre, on the contrary, exercises no such influence, one attack affording no guarantee against another. My own experience would lead me to believe that this conclusion should be received with great reserve.

The two varieties of chancre now described are liable to be modified in their appearances, progress, and modes of termination by local and constitutional circumstances, among which the most important are the want of cleanliness and the degree of the concomitant inflammation, the habits of the individual, the state of the general health at the time of the inoculation, and the occurrence of intercurrent diseases. The influence which these several causes are capable of exerting is, in many cases, so great as to change the whole outward feature of the existing ulcer, and hence those numerous divisions and subdivisions of chancre into species and varieties which, even up to the present moment, disfigure the nomenclature of syphilis, and which have tended so much to embarrass the progress of our knowledge. It is impossible for this disease to observe the same uniform course in every instance; alterations are inevitable, and must often occur despite the utmost caution both of the patient and his attendant. In this respect, a chancre holds

the same position that an ordinary ulcer does, presenting one appearance to-day and another to-morrow; now highly inflamed, and now almost free from irritation; at one time in a healing condition, and at another ready to commit the most destructive ravages. Out of these appearances, or varieties of appearances, have sprung the so-called inflammatory, diphtheritic, phagedenic, and sloughing chancres, with several others which it is unnecessary here to mention. Such occurrences constitute complications of disease rather than species and varieties, for they are liable to take place in all sores whatever their character, whether simple or malignant, specific or common. There is reason to believe that in syphilis the specific poison may sometimes undergo such a radical, fundamental change as to adapt it, in an especial manner, for the production of these differences in the appearances of the local affection. Promiscuous intercourse with badly diseased women, particularly if these women are foreigners, and receive the embraces of a considerable number of men in rapid succession, would seem to be a powerful predisposing cause of these accidents. It was observed by the surgeons who accompanied the British army into Portugal, that many of the soldiers who had connection with the native prostitutes suffered severely from phagedenic and gangrenous ulcers, while the residents of the country experienced very little trouble, and usually soon recovered from the effects of the disease. The French soldiers during Bonaparte's campaign in Egypt suffered in the same manner. Similar phenomena are frequently witnessed in the inmates of the houses of ill-fame in crowded cities. Thus in London, in Swan Alley, a narrow lane, celebrated as the residence of the humblest class of prostitutes, half-starved, badly clothed, nearly constantly intoxicated, and having frequent intercourse every day with filthy lascars and every description of vagabonds, many of the cases of chancre assume the worst possible type, running rapidly into phagedenic action, and often causing frightful ravages and even loss of life. Examples of a like kind came under my observation in this city, in 1827, 8, and 9, in the Philadelphia Almshouse, and in the numerous brothels which then existed among the low blacks and whites south of Pine Street.

All chancres are inflammatory affections, and it is only therefore when the concomitant action assumes a grave type that it can be regarded as unnatural. Under such circumstances, the characteristic symptoms consist of inordinate pain and swelling of the parts more directly involved in the disease, accompanied by an increase of discoloration, and an unhealthy aspect of the ulcer, which is the seat of a thin, ichorous discharge, more or less abundant, and generally a good deal irritating. Morbid erections are frequent, the prepuce is disposed to be œdematous, and the whole organ appears to be enlarged, especially the anterior extremity. When the inflammatory action transcends certain limits, it may pass into gangrene or destructive ulceration, as occasionally happens in common ulcers of the leg, and from similar causes, especially from excessive indulgence in the use of ardent spirits, loss of sleep, bad air, an impoverished diet, and improper courses of mercury. Or, the overaction may be brought on by a plethoric state of the system, and a neglect of the requisite depletion. I have

seen gangrene and phagedenic ulceration of the genital organs of both sexes occur at a very early period, in consequence, apparently, merely of too active a course of treatment soon after the establishment of the disease, and such cases are sometimes characterized by extraordinary rapidity of progress, the suffering parts being as it were overwhelmed by the disease.

Gangrene, as a consequence of chancre, is more apt to invade the prepuce than the head of the penis, and, what is remarkable, the upper portion of this muco-cutaneous pouch is more frequently affected than the lower or lateral. Occasionally both structures are attacked simultaneously, or, if one suffer first, the other is soon attacked also, and in this manner the whole organ may gradually be involved, dropping off perhaps ultimately near the scrotum, or at its attachments to the pubic bones. The occurrence of gangrene is announced by a blackish spot, preceded and accompanied by a burning, smarting pain, and by an aggravation of all the other inflammatory symptoms. The system is extremely feverish, the pulse is frequent and irritable, sleep and appetite are impaired, or, more commonly entirely destroyed, and the patient is often slightly delirious. When the prepuce alone suffers, the whole of it may slough off, or, what is not unusual, it may be perforated at one or more points, the largest opening perhaps admitting the head of the penis, as seen in the annexed sketch (fig. 66). A common effect of gangrene, consequent upon chancre, no matter where situated, is the destruction of the specific poison, thus effectually preventing inoculation of the system, provided that had not previously taken place.

Fig. 66.



The sloughing sore, as affecting the penis. The prepuce almost gone; the glans going.

Phagedena is a rare complication of chancre, especially in the better classes of subjects; it is analogous, in its worst forms, to hospital gangrene, and is most liable to show itself in persons whose constitution has been ruined by intemperance and other debilitating influences. As already stated, it sometimes occurs as an endemic, and is then probably induced by a foul state of the atmosphere, as when the disease breaks out in the crowded wards of public institutions; or by some peculiar modification of the syphilitic poison, greatly heightening its virulence, as when it takes place in soldiers after having cohabited with foreign prostitutes. The morbid action deports itself variously; in general, it extends rather slowly, but continuously, gradually but effectually eroding the parts, and thus widening the breach as well as deepening it. Or, it may be that, as one portion of the chancre heals, another spreads. Or, the action may be very acute, extending with extraordinary rapidity, and committing excessive ravages in an almost incredibly short time. Or, lastly, the erosion may be conjoined with gangrene, the textures dying both molecularly and in mass. The phagedena may begin soon after the appearance of the chancre, or it may manifest itself, as is most generally the case, at various periods of its progress. It may occur upon any portion of the genital organs, but is most common upon

those parts of the mucous surfaces which are most plentifully supplied with follicles. In the male it is most liable to appear in the gutter upon the head of the penis, or at the point of reflection of the prepuce. The under surface of the penis, at the side of the frenum, is another favorite site, and when chancre occurs here it is almost certain to destroy this fold of mucous membrane.

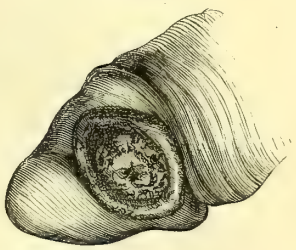
The appearances of the acute and chronic forms of phagedenic chancre are illustrated in the accompanying sketches (figs. 67 and 68).

Fig. 67.



Acute phagedena, burrowing beneath the integuments of the penis.

Fig. 68.



Chronic phagedena; with great surrounding hardness.

The phagedenic complication is sometimes followed by grave hemorrhage, the erosive action laying open a considerable sized artery, as the dorsal artery of the penis, from which blood may issue in such quantities as to induce severe, if not fatal exhaustion. The scarlet hue of the fluid and the saltatory character of the stream will at once indicate its source. In some cases it oozes from the ulcerated surface from many points, as water oozes from a sponge.

Chancres sometimes assume a *serpiginous* form, the erosive process, as the term implies, creeping about in different directions, generally in circles or semi-circles, one portion of the sore being perhaps cicatrized while the other is steadily advancing at the opposite point. The ulcer, although generally superficial, occasionally penetrates to a considerable depth, and, as its course is usually chronic, it often results in serious mutilation. Its surface, incrusted with grayish or drab-colored lymph, is bathed with ichorous fluid, and its edges are steep, ragged, and more or less everted. The serpiginous form of chancre is most common in persons of strumous constitution, especially such as are predisposed to phthisis, scurvy, and herpetic affections. It is generally remarkably obstinate, occurs almost exclusively in the skin, and manifests no disposition to burrow.

When a chancre is covered with a thick layer of lymph, it constitutes what the French syphilographers have called the *diphtheritic* chancre; such an occurrence is very common in all ill-conditioned specific ulcers upon the genital organs, and is always denotive of an unusually irritable and inflamed condition of the part, the action of which altogether transcends the healthy limits, nature being incapable of converting the deposit into granulations, and so throwing it off in the form of a slough, or as an effete substance. A considerable effusion of lymph is often observed in connection with the indurated chancre, but the soft chancre is by no means exempt from it.

Diagnosis.—The diagnosis of chancre is often difficult and sometimes impracticable, particularly in its earlier stages, before the disease has

assumed its more distinctive features. The affections with which it is most liable to be confounded are herpes, eczema, balanitis, and simple excoriations, fissures, or abrasions, the result of friction and other accidents.

Herpes, as will be seen in its appropriate place, is an eruption of the prepuce and head of the penis, appearing in the form of little vesicles, hardly as large as the head of a pin, occurring in groups, closely set together, of a whitish color, and resting upon a florid base, with which they form a striking contrast. They are most frequent on the inner surface of the prepuce, in persons of red hair and tender skin, and often appear in successive crops, none of which last longer than six or eight days. They are characterized by a sense of itching and a slight serous discharge, manifest little disposition to extend, and usually promptly yield to very simple treatment. The resulting ulcer is always free from induration.

Chancres never put on the appearance of herpes. The only approach to it is where the specific ulcers are seated in the mucous follicles, but in this case their circular form and excavated character will always serve to distinguish them from common sores.

Eczema is also an eruptive disease, but the little vesicles are more minute and diffused than in herpes, and there is also usually a greater amount of local irritation, the parts being swollen, hot, red, and itchy. When these vesicles burst, a thin watery fluid escapes, followed by the development of little delicate scales. The affection is apt to become chronic, and then little crevices generally form, increasing the irritation, and furnishing an acrid, sero-purulent, sanious, or ichorous discharge. Eczema is most common on the prepuce, and is often particularly conspicuous at the free border of this muco-cutaneous covering. A careful examination of the affected parts, the history of the case, and the co-existence of the disease with eczema elsewhere will always enable us to draw a correct distinction between this affection and chancre.

It is probable that an inexperienced practitioner might mistake an incipient balanitis for a chancre, but no one that has ever seen the two diseases could possibly commit such an error. In balanitis the inflammation is generally widely diffused, often, indeed, over the whole surface of the prepuce and head of the penis, and the discharge is not only profuse but of a thick muco-purulent nature from the very commencement. There is no circumscribed ulceration as in chancre, and, indeed, no tendency whatever to destruction of tissue. These characters will always serve to prevent the disease from being confounded with chancre, which, whether indurated or soft, invariably presents itself as a distinct and well-defined ulcer.

Simple ulcers, abrasions, or excoriations are liable to appear upon the prepuce and head of the penis, and may, unless great caution is exercised, be mistaken for chancres. They may proceed from a great variety of causes, as want of cleanliness, friction of the pantaloons, injury received during connection, and intercourse with filthy females, especially such as are habitually the subjects of profuse and acrid discharges. However induced, such ulcers are always very superficial,

and display no disposition to extend in depth, although they may spread considerably in diameter. The discharge which attends them is of an ichorous character, and they are usually surrounded by an inflammatory border, which is not the case in chancre. The most important diagnostic feature, however, by far, is that such ulcers always very promptly disappear under the most simple remedies, attention to cleanliness, with a cooling lotion and a mild aperient, generally sufficing to effect a cure in a few days.

The site, size, shape, appearance, and course of chancre, considered separately, afford no reliable diagnostic evidence; but viewed collectively they are of great importance as means of discrimination. Thus mere site and size are of no consequence, because a chancre may, like a common sore, occur on any portion of the penis and be very diminutive, as when, for instance, it occupies a mucous follicle; but if, in addition to this, the ulcer is found to be excavated, to have a foul diphtheritic bottom, to pursue a chronic course, and to resist the ordinary means of cure, it is quite impossible to mistake its character; we conclude that it is specific, and nothing else. The indurated chancre is too well marked not to be recognized; it may, it is true, not be so easy to do this during the first few days of the disease, but it is altogether impossible to be deceived when the sore has attained its proper development, the hardened base to which it owes its name being then of itself sufficient to settle any doubts respecting the diagnosis.

The history of the case often affords valuable information. If the patient is a married man, or if he has any other motive for concealment, he will be likely to deny that he has had impure connection, and even insist upon it that the sore on the penis is non-specific. Under such circumstances, it is not necessary to try to convict him of falsehood; the surgeon examines the parts, and if he finds any suspicious looking ulcers, he will be very apt to conclude that they are syphilitic, and this opinion will be strengthened by the very denials of the patient, especially if he is noted for his gallantries. Young unmarried men usually treat their attendants with entire candor, generally specifying with great particularity the time of the impure connection, and evincing no little anxiety to afford them all the light they can with a view of settling the diagnosis. We must, therefore, on the one hand, not believe that a man has not been exposed to infection simply because he says so; and, on the other, it must not be taken for granted that every sore that may be found upon the penis is of a specific nature.

Finally, in all cases of doubt the groins are to be examined with reference to the existence or non-existence of bubo. In the ordinary non-specific affections, above described, the occurrence of ganglionic enlargements is extremely rare, and when it does happen it usually appears early in the attack, and is small in extent, at the same time that it is comparatively transient. In chancre, on the contrary, bubo seldom comes on before the end of the third week, and the swelling, besides being generally considerable, is always persistent, frequently passing into extensive suppuration and ulceration.

When the above means of diagnosis fail, which will seldom be the case if we are careful, the only other resource is inoculation, a small

quantity of the suspected matter being inserted, upon the point of a lancet, in the skin on the inside of the thigh. If the operation is speedily followed by a vesicle, and this, in its turn, by a pustule, with a well-marked areola, there can be no doubt whatever respecting the true nature of the disease. Inoculation, if properly executed, cannot deceive, and is, therefore, after all, the only true and reliable test, although there are few surgeons of experience who will not, as a general rule, be able to determine the diagnosis without its aid.

Treatment.—The treatment of chancre must be conducted with a twofold object; the prevention of the absorption of the specific poison into the system, and the rapid and effectual healing of the sore. If the poison be permitted to enter the lymphatic vessels, constitutional contamination will be inevitable, and the result of such a vice may be a long train of evils, which may continue during the rest of the patient's life, and, if he be married, even show themselves in his offspring.

The prevention of the absorption of the virus constitutes what is called the *abortive* treatment, and should be an object of earnest solicitude in every case of the disease. Observation has proved that, if the specific character of a chancre can be effectually eradicated before the end of the fifth day from the inoculation, the constitution will completely escape contamination, the chancre being up to this time a purely local affection. The matter secreted by the indurated chancre, which is the more common, although, as has been seen, not the only source of infection, does not possess any specific properties prior to this period, or, if it do, it does not appear to be amenable to absorption until the part has acquired a certain degree of development, of which the hardened and circumscribed base forms a most important and characteristic element. Up to this time it is almost certain that the matter may, by proper management, be prevented from reaching the system, and exerting any deleterious impression upon it; but it is not equally certain that this procedure may not occasionally secure such immunity after this period, from the poison being unusually long delayed in the chancre, or, what is tantamount to this, from an indisposition on the part of the absorbents to carry it into the system. Hence, if there be no decided contra-indications, growing out of the existence of severe inflammation, or inordinate size of the sore, the patient should have the benefit of the abortive treatment even after the lapse of the first week or ten days, although the chances of success will then undoubtedly be much diminished, as far as the security of the system is concerned.

The abortive treatment is mainly of a local nature. The best plan of getting rid of the chancre is to dissect it out from the parts upon which it rests with a pair of forceps and a delicate bistoury, being careful to cut sufficiently widely around the diseased structures, so as to embrace the whole of them in the incisions. The operation requires some skill, but it is soon over, and, although a little painful, is rarely attended with any bleeding. Some caution is necessary, especially when the chancre has existed for an unusual length of time, to avoid inoculation of the wound; a circumstance which might readily happen if the surface of the sore were permitted to come in contact with it.

When the excision is completed, the part is to be treated with mild measures, like any common wound, and will generally heal in a very short time.

If the patient should object to the employment of the knife, or if the nature of the case be such as to induce the belief that excision cannot be effected without the danger of inoculating the raw surface, an attempt must be made to accomplish the object by means of escharotics. For this purpose several articles are in common use among the profession. The one most generally selected is a piece of nitrate of silver, cut to a very delicate point, and inserted into the ulcer, or broken vesicle, being held there until the infected tissues are brought thoroughly under its influence. The objection to this substance is its insufficiency; for, whether it acts simply as a neutralizer of the poison or as a destructive of the tissues, it is equally certain that it is generally unreliable, and hence it ought never to be used in a case of such a serious nature. The article to which I have long given the preference, and which I believe to be superior to every other for the purpose, is the acid nitrate of mercury, prepared according to Bennett's formula, and applied either pure or variously diluted, according to the exigencies of each particular case. A good average strength is one part of the acid to double that quantity of water, applied with a piece of soft wood, the end of which is smooth and well rounded off. Such a contrivance is much better than a probe wrapped with cotton, as the fluid can thus be brought in contact with the infected surface in a more concentrated and efficient manner. In order to prevent the solution from diffusing itself too widely, the parts should be previously well wiped, and immediately after bathed in pure water, or some weak alkaline lotion. The most suitable dressing will be an emollient poultice. When an escharotic is required, it is always better to make one free application than a number of imperfect ones.

When the acid nitrate of mercury is not at hand, the cauterization may be effected with almost any of the mineral acids, especially the nitric and hydrochloric. Some surgeons are in the habit of using caustic potassa, while others give a preference to the Vienna paste. Ricord has lately recommended a powerful caustic, composed of sulphuric acid and powdered vegetable charcoal, united in the proper proportions to form a semi-solid mass. Of this a thin layer is applied to the chancre and the parts immediately adjacent, upon which it soon dries, forming a black adherent crust, which, on dropping off, as it usually does in eight or ten days, leaves a healthy granulating sore, rapidly followed by cicatrization. The objections to the carbo-sulphuric paste are the extreme pain which it produces, and its tendency to spread too far over the sound tissues.

Conjointly with these local measures, it is necessary that the patient should be kept perfectly quiet for a few days, that his diet should be very light and non-stimulant, and that the bowels should be moved with some mild aperient. At the end of this time, unless there is evidence of undue inflammation, he may get up and go about his business.

The abortive treatment having failed, or the time having passed for

its successful employment, the question necessarily arises, How shall the case be managed in order to secure a prompt and satisfactory result? Supposing the chancre to be one of a simple character, unaccompanied by severe inflammation, the treatment ought to be of a correspondingly simple nature, all harsh and irritating applications being studiously avoided, inasmuch as they never fail to do harm, and thus retard recovery. From neglect of this precaution many a sore upon the genital organs that would, if gently managed, disappear in a few days, is often protracted for weeks, if not months, to the great detriment both of the part and system. Young practitioners, in particular, are apt to fall into this error; their experience being limited, and their knowledge of the disease being derived rather from books than from clinical observation, they think they cannot do too much, and the consequence is that they fret and worry the sore until it places itself, so to speak, in a state of open rebellion, resenting all measures, local and constitutional, that are used for its cure. Instead of this, none but the most soothing means should be adopted, the object being to coax the disease, not to force it into terms.

One of the first and most important points to be attended to, in every case, is cleanliness. This is best secured by frequent ablutions, or, what is preferable, by immersion of the penis repeatedly during the twenty-four hours in tepid water, containing a little common salt, acetate of lead, or chloride of soda. If the chancre be concealed by a tight and inflamed prepuce, free use should be made of the syringe, as it will be impossible to effect retraction to an extent sufficient to accomplish the purpose. In the intervals of these local baths, which, while they serve to keep the parts nice and clean, contribute materially to the reduction of the concomitant inflammation, the ulcer should be kept constantly covered with a small piece of patent lint, wet with a weak solution of tannin and opium in compound spirits of lavender, yellow wash, or the dilute ointment of the nitrate of mercury, in the proportion of one part to six or eight parts of simple cerate. The tannin and opium constitute an excellent remedy, exerting at once an astringent and soothing influence, greatly promotive of healthy action. They form the principal ingredients of the aromatic wine, so much used in the French hospitals, and their efficacy has been well attested both in public and private practice everywhere. The yellow wash is also a very valuable remedy, but to obtain all the good which it is capable of yielding it should be employed very weak, as one-eighth of a grain of the mercury to the ounce of water, the strength being increased if it be found necessary on account of the slow progress of the case. The officinal preparation is much too strong and irritating, and must therefore be scrupulously abstained from. In my own practice I have derived great benefit from the ointment of the nitrate of mercury, diluted as above mentioned, and applied either alone or in union with tannin and opium. In fact, there is no remedy which has done better or more efficient service in my hands than this in the treatment of simple chancre. I am aware that by many all greasy articles are denounced as being injurious, in consequence of their alleged tendency to become decomposed and rancid. Such objections, however, can

only be considered as having any force when these applications are too long continued, or when there is a want of attention to cleanliness, the secretions being allowed to accumulate unduly, so as to promote putrefaction. All this may be readily obviated by changing the dressings every five or six hours, and taking care that the ointment shall always be as fresh as possible.

There is one important rule which applies here with as much force as in the case of common ulcers, and that is to vary the dressings whenever they are found to be unproductive of benefit, making them now weaker, now stronger, adding new ingredients, or omitting old ones, or changing the remedy altogether. Much of the success, in every case, will depend upon the care with which this rule of practice is carried out.

When the parts begin to granulate, the simplest dressings generally suffice; such as common ointment, Turner's cerate, diluted with five or six times its bulk of fresh lard, or merely a bit of dry lint carefully interposed between the contiguous surfaces. The latter application often promotes cicatrization with remarkable rapidity.

When the head of the penis is swollen and painful, it must be kept constantly buried in an emollient poultice, made of powdered elm bark or ground linseed, and frequently changed. Or, instead of this, the warm water-dressing may be used, its efficacy being increased by the addition of laudanum and acetate of lead. It need hardly be added that the organ should be incessantly maintained in an elevated position, just as any other part of the body in a state of inflammation.

Constitutional treatment is important, and must therefore claim due attention, however simple the sore. Perfect quietude of mind and body is indispensable in every case. The effects of any disturbance of this kind are sure to be promptly seen in the aspect of the sore and the character of the secretion. The diet must be plain and simple, animal food and stimulants being carefully avoided; the bowels must be kept open by cooling purgatives; and, if need be, free use must be made of the saline and antimonial mixture. Venesection will rarely be required, and then only in very plethoric subjects. If the local trouble be considerable, leeches may be applied to the groins or the inner surface of the thigh, care being taken to cover the bites, when the flow of blood has ceased, with collodion, in order to prevent their inoculation from the accidental contact of the chancrous matter. These animals should never be applied to the penis itself, much less to the parts immediately affected, as their secretions could hardly fail to come in contact with them, and so propagate the disease. If the ulcer belongs to the indurated variety, or if it be followed by a suppurating bubo, a moderate course of mercury will be proper; but as this is a subject which will come up for consideration by and by, it will not be necessary to enlarge upon it here.

Chancre, complicated with undue inflammation, phagedena, gangrene, or excessive inactivity, requires some modification of treatment, adapted to the peculiar conditions of the part and system which are always present under such circumstances, and which may, therefore, be regarded, in the true acceptation of the term, as so many exciting

causes of the morbid action. It is only by bearing in mind the intimate relation subsisting between the local disorder and the state of the constitution, and the influence which they reciprocally exert upon each other, that the practitioner may hope to treat these epiphenomena with any immediate prospect of success.

When chancre is accompanied by severe *inflammation*, as denoted by the swollen, discolored, and painful condition of the parts, and the feverish state of the system, recourse must at once be had to the vigorous employment of antiphlogistics, for the purpose of moderating, as promptly as possible, the violence of the disease. Bleeding at the arm, active purgation, light diet, and the use of antimonials, with absolute rest in the recumbent posture, cooling, anodyne, and mildly astringent lotions to the ulcer, and an emollient poultice or the warm water-dressing for the head of the penis, constitute the chief remedies in such an emergency, and must be carried to an extent compatible with the powers of the system. Pain and morbid erections are relieved with opiates, administered in full doses. By these means the disease is soon brought under subjection, when it is to be managed in the same gentle manner as the milder forms of chancre already described.

When the ulcer assumes a *phagedenic* character, manifesting a disposition to spread more or less rapidly both in depth and diameter, the principal addition to the treatment, required in chancre complicated with undue inflammation, consists in the increased amount of opium employed to soothe the part and system, which are generally excessively irritable in this variety of morbid action, and can only be successfully quieted by the most liberal use of this article. If the skin be hot and arid, the pulse excited, and the face flushed, the opium should be combined with antimony, or some cooling diaphoretic, so as to produce a decided determination to the surface. The diet and bowels must receive due attention; all stimulants must be avoided; and the mind and body must be maintained in the most tranquil condition. If mercury has been given, its use is at once to be abandoned, experience having shown that, under such circumstances, it not only produces great harm, but that in many cases it is the principal cause of the phagedenic action.

The local applications should all be of the blandest kind, consisting of warm water-dressing or emollient poultices, and of lint steeped in mucilage of gum arabic, or an infusion of elm bark, with the addition, to each ounce of fluid, of from two to three drops of nitric acid and one drachm of the vinous tincture of opium. If the disintegrating action is very rapid, the ulcer should be touched freely with a solution of the acid nitrate of mercury, or a piece of solid nitrate of silver, its surface being kept constantly covered in the interval with the medicated lotion just mentioned. In some cases nothing will arrest the erosive tendency so speedily as a weak solution of sulphate of copper, in the proportion of from half a grain to a grain to the ounce of water, with the addition of from four to six grains of tannin and opium.

The phagedenic form of chancre, however, does not always occur in the strong and robust; the system may be, and often is, in an ady-

namic condition, and when this is the case tonics and stimulants instead of depressants will be required. The constitution, degraded perhaps by long suffering or by all kinds of intemperance and starvation, must be brought up by quinine and iron, with porter, ale, or milk punch, a nutritious diet, and change of air, particularly if the patient be the inmate of a crowded and ill-ventilated hospital. The dissipated and enervated residents of large cities are particularly prone to suffer from phagedena during the progress of chancre, and the practitioner, therefore, cannot be too much upon his guard how he depletes this class of individuals. What is needed in such a state of the system is perfect tranquillity of mind and body, as secured by the liberal exhibition of anodynes, and a better condition of the blood, to enable the part to institute a more salutary action.

If *gangrene* set in, the treatment must vary according to the concomitant state of the system, independently of any consideration growing out of the presence of the specific virus. The question should simply be, is the action on the part of the system too high or too low? If the former, antiphlogistics will be indicated, and should be promptly employed, although not without a certain degree of restriction, lest the powers of the constitution should suffer from the effect, and thus promote the spread of the disease. The lancet and purgation must be used warily; the practitioner must measure his ground and feel his way. The excitement may only be apparent, not real; and may, consequently, shortly subside, either spontaneously, or under very simple remedies. Most likely the action is typhoid from the beginning, or, if not, it soon will be; and hence, instead of depletion, a corroborative course of management will be necessary, similar to what is practised in ordinary gangrene in other parts of the body, our chief reliance, so far as constitutional means are concerned, being upon quinine, ammonia, brandy, camphor, and opium, with jelly and rich animal broths.

As it respects the part itself the treatment must be twofold; first, to arrest the gangrenous action, and secondly, to promote the separation of the eschars. To fulfil the first of these indications, the affected parts are freely painted with the dilute tincture of iodine and wrapped up in an emollient poultice, medicated with laudanum and acetate of lead, while the dying tissues are well mopped with the acid nitrate of mercury, or brought under the full influence of the solid nitrate of silver. If any constriction exist, such as that produced by a tightened and retracted prepuce, it must be promptly relieved with the knife. The detachment of the sloughs may be promoted artificially, or, if not too large, be intrusted entirely to nature's efforts; at all events, all harsh interference must be carefully avoided. Fetor is allayed by the chlorides.

The sloughs having separated, the next object is to invite the development of healthy granulations; and for this purpose the most available remedies will be found to be the nitric acid lotion, with tincture of opium, the ointment of the balsam of Peru, the aromatic wine, or the dilute ointment of the nitrate of mercury, with the warm water-

dressing or an emollient cataplasm, as a general covering to the affected structures.

Chancre attended with deficient action—the *indolent* sore of some syphilographers—demands for its successful management a careful investigation of the nature of the exciting cause of this particular state of the part before recourse be had to direct treatment. In general, it will be found to depend upon some defect of the system, by correcting which the ulcer will speedily assume a healthy appearance, throwing out florid granulations, secreting thick, laudable pus, and cicatrizing along its margins. Or it may be that the impediment is of a strictly local nature, caused by want of cleanliness, by an undermined condition of the sore, or, finally, by the presence of a thick, semi-organized layer of lymph, firmly adherent to the surface of the chancre. Whatever the difficulty may be, it should, if possible, be promptly rectified; the constitution, if at fault, is improved, and the part is treated with special reference to the promotion of the granulating process. Particular attention is given to cleanliness, the hardened and shelving edges are trimmed off with the knife, and the incrusted surface, freely cauterized with the nitrate of silver or acid nitrate of mercury, is kept constantly covered with blue ointment or some stimulating lotion.

The indolent form of chancre is frequently accompanied with an indurated base, which often continues a considerable period after the ulcer has become completely cicatrized, and constitutes a variety of primary syphilis peculiarly dangerous on account of its liability to be followed by constitutional symptoms. The idea now almost universally prevails, and I think very justly, that no person is safe from constitutional contamination so long as the part remains in this condition. It is an evidence, and one of an incontestable character, that the specific virus still lingers at the original seat of the infection, and that, like a smothered fire, it may spring up at any moment into a full blaze, re-exciting ulceration, and endangering the system. It is to this form of chancre, more particularly, that mercurialization is applicable, very few patients thoroughly recovering without it. The manner in which it should be conducted has given rise to much discussion, and is deserving of special attention.

My own opinion is that the more simple and gentle the *mercurial* course is the better. It should be carried just far enough to affect the gums, and no further. The object is not to cause profuse salivation, as was the wont of the older surgeons, but merely to cause slight soreness of the mouth, as an evidence of the constitutional impression, and to maintain this impression, in an equable, uniform manner, until the local affection has completely disappeared. The preparation which I usually prefer is calomel, in doses of from one to two grains three times a day, in union with a little opium, or, if there be dryness of the surface, with morphia and ipecacuanha. Blue mass is also a valuable article, and may often be employed as a substitute for the calomel, especially in the young and delicate. As soon as the medicine has produced a slightly salivant effect, or soreness of the gums, it is to be discontinued, or given in smaller doses and at longer intervals. If the desired result be slow in coming on, the treatment may be aided by mer-

curial inunction, from one to two drachms of the blue ointment being rubbed on the inside of the arms and thighs morning and evening.

I prefer calomel, blue mass, and mercurial ointment to the more modern preparations of mercury, chiefly for the reason that they are less liable to gripe, and also because they are more certain and reliable in their effects. Iodide of mercury, the article usually resorted to by modern practitioners, nearly always causes intestinal irritation, and is, as I know from ample experience, generally very tardy and unsatisfactory in its action. The bichloride, so valuable in the tertiary form of syphilis, is not a reliable medicine in chancre, except, perhaps, in cases of extraordinary chronicity, in which I have sometimes given it with much benefit, in doses varying from the twelfth to the eighth of a grain every eight hours.

Mercury must not be employed, in any form, in the treatment of primary syphilis, if there be fever, or general excitement of the system. In such a case the patient must be subjected to a certain amount of preliminary treatment, consisting of rest, abstinence, purgation, and the use of salines and antimonials. A similar course is to be followed in phagedena and gangrene, or even when there is merely an unusually irritable state of the constitution. Exhibited under such circumstances, the mineral never fails to produce mischief, by increasing the local trouble and the general derangement. The great art of administering mercury in this and other diseases is to know when and how to give it; never to employ it sakelessly, or simply because it is mercury, but to give it for a good reason; and in order to do this properly a great deal more judgment is required than is generally imagined. Upon the manner in which the article is used in primary syphilis will, in great degree, depend the future welfare of the patient.

There can be no question that primary and even secondary syphilis are often curable without mercury. Every practitioner meets with cases where none but the most simple means are necessary to attain this object promptly and satisfactorily. For the last twenty years I have rarely given this mineral in any case of these two forms of the affection; and, although tertiary symptoms have occasionally supervened upon this mode of treatment, I have, on the whole, had no cause whatever to regret it, but quite the contrary. The value of the non-mercurial treatment was fairly tested, in hundreds, if not thousands, of cases, by the British surgeons, during the Peninsular wars, and their results, as published by some of their most enlightened and reliable brethren, prove, in the most positive and irrefragable manner, that primary syphilis may generally be effectually relieved by ordinary antiphlogistic means. It was found that the average period occupied by the treatment of chancre unaccompanied by bubo, without mercury, was twenty-one days, a little more than twice this period being required when the sore was followed by bubo. On the other hand, the cases that were treated with mercury required, for the cure of the chancre, an average of thirty-five days, and for the chancre and bubo fifty days. The results of the practice of certain hospitals are equally corroborative of the value of this treatment. Thus, in the various hospitals of Sweden, of 20,000 cases treated with mercury, the num-

ber of relapses amounted to thirteen and two-thirds in the hundred; whereas, in a like number of cases treated by the simple method, the proportion of relapses was only seven and a half. In the Hamburg Hospital, out of 1649 patients, of both sexes, 582 were treated with mercury, and 1067 without mercury; the mean duration of the cure in the former was eighty-five days, and of the latter, fifty-one days. At Strasbourg, 5271 persons were treated without mercury, with hardly any relapses and secondary affections.

The above results are greatly in favor of the non-mercurial plan of treatment; and they deserve the more attention because it was formerly believed that the primary disease, when so relieved, is more liable to be followed by constitutional symptoms than when the patient gets well without the aid of the mineral. Finally, another fact developed by the British observers, and one repeatedly noticed in private and hospital practice since, is that when mercury is exhibited in undue quantities, and especially in states of the system not properly prepared for its reception, the constitutional contamination is apt to be of the very worst kind, a sort of mercurio-syphilitic diathesis being established, which, in its remote effects, is more unrelenting and irradicable than the original disease, however severe.

If *hemorrhage* arise during the progress of chancre, no time should be lost in arresting it; the patient may be already much exhausted by previous suffering, and a slight drainage of this kind might therefore prove eminently prejudicial to his recovery. When the blood issues unmistakably from an open orifice, it should at once be secured by ligature or the compressing forceps, a sufficiency of tissue being included in their bite to insure safe maintenance. If, on the contrary, it proceeds from many points, the ordinary styptics will generally suffice for its arrest, especially if the system be promptly brought under the influence of opium.

The morbid *erections* which so often accompany chancre, and which generally so much impede the reparative process, must be treated in the same manner as in gonorrhœa; by the liberal use of anodynes by the mouth or rectum, and by soothing topical applications, either warm or cold, as may be most grateful to the part and system. If hemorrhage be present, they must be controlled at all hazards, on account of their tendency to tear open the bleeding vessels.

Phymosis, complicating chancre, must not be interfered with, unless it act constrictingly, threatening destruction both of the prepuce and the glans by mortification. In this event, the parts must be freely divided upon the grooved director, the edges of the incision being immediately cauterized with nitrate of silver or acid nitrate of mercury, to prevent inoculation. In ordinary cases, the tightened foreskin is permitted to retain its place, cleanliness and medication of the ulcer being effected by means of the syringe, as already stated.

Paraphymosis is occasionally present, perhaps to a perplexing and even dangerous extent. The constriction produced by it may be such as to cause excessive œdema of the prepuce, and great engorgement, if not severe swelling, of the head of the penis; inducing a condition

of things which, if not speedily relieved, may eventuate in extensive gangrene. These effects may be brought about whether the chancre be situated on the glans or on the retracted prepuce, and, for the reason just mentioned, always demand prompt attention. An attempt should be made to restore the parts, if possible, by manual efforts, and to facilitate these efforts it may not be improper to administer chloroform, to give the surgeon more perfect control over his movements. If the attempt fail, the only alternative is to divide the stricture, care being taken afterwards to keep the wound well coated with collodion.

Chancre of the Urethra.—Chancre occasionally attacks the urethra; probably much oftener than is generally supposed, although its relative frequency to chancre of the prepuce and head of the penis has not been determined. The fact that this disease is liable to occur here was not known, even to the most enlightened syphilographers, until within a comparatively recent period, and hence it is not surprising that many of them should have considered gonorrhœa as capable, in some cases, of giving rise to secondary symptoms. The chancre being concealed in the urethra, the discharge which attended it was regarded as being exclusively the product of gonorrhœa, and the ignorance which existed upon the subject would probably never have been removed if it had not been for the practice of inoculation. The numerous experiments which have been performed upon the subject have proved, beyond the possibility of doubt or cavil, that gonorrhœa is a mere local affection, and that, whenever any constitutional syphilitic phenomena occur as a consequence of a urethral profluvium, those phenomena are due, not to the effects of gonorrhœa, but to those of a urethral chancre.

Chancre of the urethra is generally situated just behind the meatus, or in that portion of the tube which corresponds with the glans; I have several times met with it on the lips of the external orifice; and in the case of a young gentleman, recently under my care, I found a well marked indurated chancre at least two inches behind the anterior extremity of the tube. The disease occasionally, though very rarely, extends over nearly the whole of the urethra, as far back as the neck of the bladder.

The period of latency of chancre of the urethra is much longer than in the ordinary form of the disease, which, on an average, does not exceed four or five days; here, on the contrary, it is rarely less than three and a half or four weeks. The reason of this would seem to be that the specific virus, being entangled in one or more of the lacunæ of the tube, is incapable of exciting the same rapid influence as when it is brought in contact with an abraded surface upon the head of the penis. Moreover, it is extremely probable that only a very small quantity of the poison generally finds its way into the urethra, and that, consequently, it has great difficulty, so to speak, not merely in effecting a secure lodgement, but in so multiplying itself as to enable it to produce ultimately an explosive effect upon the mucous and submucous tissues. The urine, passing along the tube soon after the intromission of the specific fluid, will, in general, either wash it entirely away, or, combining with it, effectually neutralize its properties.

The discharge attendant upon chancre of the urethra is generally less copious than in ordinary gonorrhœa; it is also more thin, and of a lighter color, unless the accompanying inflammation is unusually severe, when it may be both profuse and of a thick, bloody character, or thick and yellow with a greenish tinge. There is generally some degree of scalding in micturition, though hardly ever as much as in gonorrhœa, and the site of the chancre is nearly always indicated by a sense of hardness, or a kind of lump which can be easily perceived by the thumb and finger. When the disease affects the anterior extremity of the tube, it is not uncommon to find great induration of the whole head of the penis with a red and phlogosed appearance of its mucous covering, and considerable tumefaction of the prepuce. Morbid erections are not only frequent but often very painful and troublesome. The disease is usually chronic, and rarely gives rise to fever, although it is liable to be followed by secondary and tertiary symptoms. Bubo is not one of its ordinary effects; but a certain amount of contraction of the urethra nearly always is.

The *diagnosis* of chancre of the urethra is often difficult. It is certainly easy enough when it is situated at the lips of the meatus, or just behind the orifice, the separation of the edges of which will then bring it fully into view, or, at all events, to an extent sufficiently satisfactory. When located farther back, its existence becomes a matter of doubt; for, although the induration which accompanies it may be very distinct, yet as a similar condition may be present in gonorrhœa, in consequence of the development of an abscess, or the escape of a drop of urine into the submucous cellular tissue, no useful deduction can be drawn from it. Perhaps the most valuable rational symptoms are, the unusual latency of the poison, or the extraordinary length of time which intervenes between the impure connection and the outbreak of the disease, the remarkable obstinacy of the attack, resisting, as it generally does, all the various methods of treatment which are commonly directed against the cure of gonorrhœa, and, lastly, the slight scalding in micturition, and the frequent variation in the nature of the discharge, which is now scanty, thin, and serous, and now profuse, thick, and yellow. The only real diagnostic character, however, is furnished by inoculation, which should be promptly resorted to in all cases of doubt on account of the selection of a proper and efficient course of treatment.

The *treatment* of chancre of the urethra is to be conducted upon general anti-syphilitic principles. The remedies which prove so serviceable in gonorrhœa are entirely inert here, except in so far as they may be instrumental in diluting the urine and depriving it of its acrimony. When within reach gentle cauterization with nitrate of silver will be beneficial, and, in obstinate cases, hardly any other direct application will be of much avail. In the intervals of the cauterization, or, in the more intractable forms of the disease, throughout the treatment, different kinds of injections must be used, especially weak lotions of sulphate of copper, tannin, and opium, acetate of lead, bichloride of mercury, and iodide of iron. If the sore be seated near the meatus, the opposite surfaces should be kept apart with a tent medicated with

the dilute ointment of the nitrate of mercury; or a small bougie smeared with this substance may occasionally be introduced. If marked induration exist, early but gentle mercurialization must be employed, both as a means of promptly curing the chancre, and of protecting the system from contamination.

Chancre in the Female.—Chancre in the female, as mentioned elsewhere, is most common upon the vulva, in the vagina, and upon the uterus, the relative frequency of the occurrence being as here stated. The perineum also sometimes suffers. The inferior portion of the vagina is much more liable to be affected than the superior, but both this part of the tube and the uterus are not nearly as often the seat of the indurated, or true Hunterian chancre, as was at one time supposed, owing probably to the fact that the infecting matter which covers the sore of the penis is wiped off during coitus before the organ has effected full penetration. The nature of the ulcer is easily recognized by its excavated shape, its steep, irregular edges, its foul, unhealthy-looking bottom, and its indurated base. In chronic chancre of the uterus, the hardness is generally wide-spread and most characteristic, the neck and mouth of the organ being almost of a stony consistence, deeply engorged, and of a florid hue.

The soft or non-indurated chancre is much more common than the indurated, the two varieties of sore following, in this and other respects, the same laws in the female as in the male. The former is often multiple, and may acquire a large size; the latter, on the contrary, is usually single, and almost always very small, its dimensions rarely exceeding those of a five cent piece. Both classes of ulcers are frequently the seat of excessive pain, especially when they attack the vulva and the inferior portion of the vagina. Their march is generally chronic, and their presence can only be satisfactorily determined by careful ocular inspection. In regard to their diagnosis, the surgeon must be guided principally by the history of the case, the character of the patient, and the appearance of the ulcers. When the ordinary means of discrimination fail, inoculation must be practised.

In the treatment of chancre in the female, the same general rules are to be observed as in the treatment of chancre in the other sex. Absolute rest in the recumbent posture, active purgation, the saline and antimonial mixture, anodynes, diaphoretics, the warm bath, and light diet constitute the principal constitutional remedies. The most important topical means are frequent injections of cold water, or cold water impregnated with some mild anodyne and astringent articles; cauterization with the solid nitrate of silver or the dilute acid nitrate of mercury; and isolation of the sores by tents of patent lint, medicated with aromatic wine, lotions of tannin and opium, yellow wash, or some slightly stimulating unguent, especially the dilute ointment of nitrate of mercury. In obstinate cases, especially in the indurated chancre, a mild course of mercury will be necessary.

2. BUBO.

Bubo is an enlargement of one or more of the lymphatic ganglions of the groin. It may proceed from a great variety of causes, tending to irritate and inflame the lymphatic vessels leading to these glands; thus it may be occasioned by gonorrhœa, excessive sexual indulgence, fatigue from protracted exercise, injury of the inferior extremity, or the presence of a boil upon the nates or perineum. Such swellings are particularly liable to occur in young subjects of a scrofulous temperament, in whom they often arise from the most trivial causes, and generally disappear without much, if any, treatment; the concomitant inflammation being usually very slight and seldom passing into suppuration. The syphilitic bubo, on the contrary, is a specific disease, the result of inoculation with the matter of chancre, and capable of furnishing a secretion similar to that by which it was itself produced. An open syphilitic bubo is, in fact, a chancre, and nothing else. Hence, like the latter, it constitutes merely a form of primary disease; for so long as the poison is limited to the glands of the groin there cannot, of course, be any true contamination of the system. It is only when it passes beyond this point that its operation can become general; up to that period syphilis is essentially a local affection.

The true syphilitic bubo rarely arises until the end of the second week or the beginning of the third from the appearance of the original sore; cases sometimes occur at an earlier period, as the seventh or eighth day, and, on the other hand, the attack may be postponed until the close of the first month. Some authorities, Puche among the rest, would have us to believe that the disease may occasionally not show itself until after the lapse of three years. Such a statement, although apparently credited by respectable authorities, is too ridiculous to be seriously entertained by any one. Nature undoubtedly constantly deviates from her established laws, but it is impossible to suppose that she could be guilty of so great a departure as such an occurrence as this would imply. We must rather conclude that the fault lies in a want of correct observation than in such flagrant violation of the laws of syphilis.

Bubo may follow either the soft or the indurated chancre, but in order to do this it is necessary, as a general rule, that the sore should be free from phagedena and gangrene, or, indeed, from severe inflammation of any kind, inasmuch as the absorption of the specific virus and its transmission to the groin are accomplished with great difficulty when the parts are overpowered by disease. An active, open state of the ulcer, and the smallest conceivable amount of inflammation in the structures immediately around, are, other things being equal, the conditions which are the most favorable to the development of the true syphilitic bubo. Considerable diversity exists in respect to the aptitude with which the two varieties of chancre produce bubo, as well as in regard to the characters of the bubo itself. Thus, the indurated chancre is always followed by bubo, the swelling, which usually involves several ganglions, being hard and chronic, and partaking more

or less of the character of the parent sore, without much disposition to suppurate, although it is sure eventually to contaminate the constitution. The pus, moreover, which occasionally forms, is not generally specific, and is for the most part of a thin, ichorous nature. The soft chancre, on the other hand, is only now and then followed by bubo; the disease, which attacks only one gland, always runs its course very rapidly, and soon terminates in the formation of an abscess, the fluid being both abundant and readily inoculable.

However produced, the specific bubo will generally be found to occur on the same side as the chancre. Thus, if the ulcer exist on the right side of the penis, the right groin will be the one to suffer, and conversely. Now and then an exception to this rule is met with, depending, there is reason to believe, upon an interlacement of the lymphatic vessels, those of the right side passing over to the left, and the reverse. A bad form of bubo occasionally occurs at the root of the penis, or upon the pubes, caused by the presence of an infected ganglion.

Both sexes are liable to syphilitic bubo; but males suffer much more frequently than females, owing to the difference in the arrangement of the lymphatic vessels, those of the former passing in a much more direct manner than those of the latter from the seat of the disease. In chancre of the uterus and upper part of the vagina bubo is uncommon, and the same law holds good in chancre of the urethra in men.

The relative proportion of bubo to chancre has not been settled; while the indurated form of the disease is very generally followed by swelling of the inguinal glands, soft chancre does not perhaps produce such an effect oftener than in one case out of four.

An opinion has extensively prevailed during the last twenty years, or more, that a bubo may form in the groin without the intervention or antecedence of a chancre, in consequence of the direct absorption of the specific poison from a mucous or cutaneous surface. It is maintained by the advocates of this doctrine that such an effect is possible, because, as they allege, bubo and even constitutional symptoms occasionally occur without any evidence whatever of their having been preceded by primary ulcers upon the genitals. They assume that the matter in which the poison is entangled, or held, as it were, in solution, may be absorbed by the mucous or even the cutaneous surface of the penis in the same manner, and upon the same principle as morphine, atropine, and other articles of the materia medica, and that, being subsequently conveyed by the lymphatic vessels to the groin, it is capable of infecting its glands in such a way as to form a true syphilitic bubo. Hence, the disease has been called the primary non-consecutive bubo, or, to use a French phrase, *bubon d'emblée.* The existence of this variety of inguinal enlargement was admitted by several of the older writers on syphilis, especially by Astruc and Swediaur, and has been dwelled upon at much length by Ricord and his disciples. Many of the most experienced practitioners, however, in all parts of the world, positively assert that they have never met with it, and, as for myself, I am quite sure that no instance of the kind has ever fallen under my observation. My belief, therefore, is that the occurrence is

a mere chimera, explicable on the supposition that the chancre which precedes it is so small and evanescent as to elude detection. It is certain that such slight and transient ulcers often do appear on the genital organs of both sexes, and that, notwithstanding they do not attract any attention either on the part of the patient or his attendant, they are yet not unfrequently followed by the worst forms of constitutional contamination.

Varieties.—Bubo, like chancre, is susceptible of a great variety of forms. Thus, it may, after having progressed a certain distance, remain stationary, perhaps even several months, manifesting no decided disposition either to advance or to recede. Conjoined with this indolent, passive, or inactive state is generally a certain degree of hardening, such as we so often observe in the chronic indurated ulcer upon the head of the penis. Such a swelling is always to be dreaded on account of the disposition which the specific poison has to lurk in the substance of the affected glands, from which, in time, there is great danger of its being conveyed into the system, so as to give rise ultimately to secondary and tertiary symptoms. The bubo, in fact, is a hot-bed, not merely for the temporary lodgement of the virus, but for its zymotic operation, and its gradual extension to other and more important structures.

In another class of cases the enlarged glands, taking on inordinate inflammatory action, pass into *suppuration*, the matter usually collecting in a solitary abscess, of an ovoidal shape, and from the volume of an almond up to that of a goose's egg. When the disease assumes this form, it generally runs its course with considerable rapidity, being characterized by severe constitutional disturbance, such as rigors, fever, and headache, and by intense local suffering, the pain being of an aching, throbbing character, the swelling great, the heat excessive, and the discoloration of a dusky livid red. If the matter, which is generally of a thick, yellowish appearance, intermingled with blood and cellular sloughs, be not promptly evacuated, it is apt to burrow among the neighboring tissues, causing extensive sinuses, which it is often extremely difficult to heal, and which occasionally lay open most important structures. In neglected cases I have seen such an abscess, more than once, pass high up over the abdomen, and low down upon the front of the thigh. In the indurated bubo, the result usually of an indurated chancre, the secretion is generally comparatively scanty, and of a thin, ichorous, sanious, or sanguinolent nature. Whenever the quantity of matter is unusually large, it may be assumed that it is furnished by the cellular tissue in which the affected glands are wrapt up rather than by the glands themselves.

When the contents of the abscess have been discharged, whether spontaneously or otherwise, the disease takes the name of an open or *ulcerated* bubo, a state in which it may remain, with very little change, for an almost indefinite period. The discharge from such a sore, which is always situated above Poupart's ligament, and which inclines from above downwards and inwards, may partake more or less of the character of laudable pus, or it may, as most generally happens, be thin, ichorous, and irritating, its quantity varying from several drachms to

upwards of an ounce in the twenty-four hours. How long it may retain its specific properties is unknown. The edges of the sore exhibit very much the same appearances as those of a common chancre; thus, they may be very steep, hard, and ragged; everted, inverted, or undermined; thick or thin; pale, reddish, dusky or purple. The bottom is usually incrusted with a dirty, greenish, or yellowish pultaceous substance, with here and there a small, fiery looking, exquisitely sensitive granulation. Sinuses often extend from the main ulcer in different directions, and it is not uncommon, when the destruction has been at all extensive, to see some of the affected ganglions lying in a partially detached state at the bottom of the sore, perhaps adhering merely by a few shreds of cellular tissue.

An ulcerated bubo may take on *phagedenic* action, extending more or less rapidly in different directions, just as in the case of a chancre occurring in an unhealthy constitution. This epiphenomenon may show itself soon after the swelling has been laid open, or not until after the lapse of several weeks or months. It is usually characterized by severe pain, by a thin, profuse, sanious discharge, and by a foul pultaceous state of the sore, along with an irritable condition of the system, want of appetite and sleep, and disorder of the alimentary canal.

Finally, a syphilitic bubo may become the seat of *gangrene;* sometimes before ulceration sets in, but usually not until afterwards. Such a termination is most apt to occur in the lower classes of patients, the inmates of cellars, prisons, almshouses, and other filthy places, and often produces the most frightful ravages, causing extensive destruction of the skin and cellular tissue, as well as, in some cases, of the muscles of the abdomen. The symptoms are generally very severe, and the disease often proves fatal, the sufferer, meanwhile, forming a most loathsome and disgusting object.

Diagnosis.—Syphilitic bubo is liable to be confounded with bubo from other causes, and hence it is by no means always easy to determine the diagnosis, desirable as it is that there should be no mistake upon a subject of such practical moment. There are a few points in connection with these two classes of swelling which are deserving of attention as means of discrimination. In the first place, the surgeon must carefully consider the history of the case. If the bubo be of a syphilitic nature it will not, as a general rule, come on until the end of the second week from the primary disease, and in many instances, indeed, not until a considerably later period. In the common bubo, on the contrary, the swelling usually supervenes within a short time after the exciting cause has begun to act. Thus, a boil upon the nates, or a corn, bruise, or other injury of the toe, is usually followed by a bubo within the first three or four days after the local difficulty has sprung up. Secondly, useful information may be obtained from the duration of the swelling. A syphilitic bubo usually lasts a number of weeks, often, indeed, several months; an ordinary bubo, on the other hand, generally promptly disappears with the exciting cause that induced it. Thirdly, the specific bubo often suppurates and ulcerates; the common bubo seldom, if ever, and then only in persons of a scrofulous and broken-down constitution. Fourthly, the matter of the syphilitic bubo

is often inoculable; of the common, never. Finally, the syphilitic swelling is always situated above Poupart's ligament, affecting mostly only one gland; the non-syphilitic swelling, on the contrary, is usually situated below that band, or partly below and partly above, and generally attacks several ganglions, though rarely in an equal degree.

The scrofulous bubo occurs only in persons of a scrofulous diathesis, mostly in children prior to the age of puberty. It commonly affects a considerable number of glands simultaneously, and they remain enlarged for a long time, being very hard and lobulated, and slowly tending to suppuration. The matter is of a yellow-greenish hue, and collects itself into several little abscesses, which, bursting, leave ill-conditioned ulcers, with thin, bluish, undermined edges, and a thin, sanious, irritating discharge, destitute of inoculable properties. The bulk of the swelling is usually situated beneath Poupart's ligament, at the upper and inner part of the thigh; and traces of strumous disease generally occur in other parts of the body.

Treatment.—The treatment of bubo must be conducted upon the same general principles as that of chancre, of which, as already stated, it is simply another form. If the disease be seen early, ere yet there is much inflammatory action or any decided tendency to suppuration, the abortive treatment will come in play, consisting of the free application of tincture of iodine, and the use of concentrated compression, either with a truss, or a series of linen pads and the spica bandage. There are few cases of incipient bubo which can resist the combined influence of these remedies, if properly managed. If the compression, in the efficacy of which I have great confidence, proves painful, it must be moderated, or altogether pretermitted for a time. Occasionally the treatment is advantageously preceded by the application of leeches.

If the disease has already made considerable progress, iodine and compression will probably prove insufficient, and then more active measures will be required. Of these, the most efficient is the formation of an eschar upon the most prominent portion of the swelling by means of the Vienna paste, applied as in making an issue, or a solution of bichloride of mercury, in the proportion of twenty grains to the ounce of alcohol. The skin having been previously elevated by a small blister, a compress wet with the lotion is firmly bound upon the raw surface, and retained for two hours, when it is replaced by an emollient poultice or the warm water-dressing. The pains produced by this application are excessive, and hence the paste usually deserves the preference, especially as it does not possess any special therapeutic advantages. The new action created by the caustic neutralizes or overwhelms the pre-existing, and rapidly destroys the specific disease.

When suppuration is threatened, or inevitable, the process should be expedited by the usual means, aided by recumbency and a relaxed position of the lower extremity. As soon as fluctuation is observed, the parts are freely divided, even if the matter be deep-seated, in order to give full vent to the confined fluid. A tent is kept in the opening to prevent closure of its edges. The incision should always be made in the direction of Poupart's ligament. If the bubo is chronic and indurated, the operation is sometimes attended with considerable

hemorrhage, chiefly, however, of a venous nature, and consequently easily arrested by pressure and quietude. When the suppurative process is very slow and imperfect, as it sometimes is, especially in the variety of bubo just mentioned, the most appropriate application is a large blister, retained sufficiently long to produce thorough vesication, and dressed with an emollient poultice. When the accumulation of pus is very large, it has been proposed to effect its evacuation, not by incision, but by a number of punctures, on the ground that the procedure would be less destructive to the integument than the more common operation. I have not, however, found such a result to obtain in my own practice. On the contrary, the skin and cellular substance are generally so much detached and impoverished as to render it impossible to preserve them with any reasonable prospect of their ultimate reunion. Hence, I am always in favor of a free division; nor do I hesitate afterwards to remove such portions of integument as may seem to act obstructingly to the reparative process by overhanging the surface of the ulcer, and interfering with its medication. If sinuses form, they must be laid open in the usual manner; fungous granulations are repressed with escharotics, as sulphate of copper and nitrate of silver, or, what is better, the scissors. If the constitution is impaired by protracted suffering and confinement, tonics and change of air will be required; and in all cases proper attention is paid to the diet, the bowels, and the secretions. Should phagedena or gangrene supervene, the same line of treatment will be demanded as under similar circumstances in chancre. The chronic indurated bubo will rarely yield in a satisfactory manner until the system is brought gently under the influence of mercury.

SECT. III.—SECONDARY SYPHILIS.

1. GENERAL CONSIDERATIONS.

The term secondary is employed to designate that group of morbid phenomena which manifest themselves after the occurrence of primary syphilis, the period of their evolution varying, on an average, from five to eight weeks from the first outbreak of the disease. The structures which are most liable to suffer are the cutaneous and mucous, and these may be attacked either simultaneously or consecutively, or one may suffer and the other escape, according to the condition in which they may happen to be at the time of the contamination.

Secondary syphilis is always preceded by chancre, for there is no reason to believe, as has been stated elsewhere, that the specific virus ever finds its way into the system by direct imbibition, or without the intervention of a breach of continuity of some kind or other. This fact is too well established to admit of any doubt. Nor is the affection always preceded by bubo; in many cases, in fact, the inguinal glands remain completely intact, and yet the constitutional symptoms may be of the very worst character, occurring, perhaps, early after the primary disease, and exploding with peculiar virulence upon the cutaneous and mucous tissues. It would be interesting, in a practical point of view,

if we could determine the relative frequency of secondary symptoms and bubo, or how often in a given number of cases constitutional syphilis occurs with involvement of the inguinal glands, and, on the other hand, how often bubo exists without being followed by consecutive derangement. For the solution of this question, however, there are, unfortunately, no sufficient data. As was previously stated, the indurated chancre is nearly always succeeded by constitutional involvement, occurring early in the disease, and generally giving rise to the most serious consequences, if not to positively irremediable effects. It has lately been insisted upon by certain authorities that the soft or non-indurated chancre is solely a local affection, and therefore never followed by any specific vice of the general system. In this doctrine I cannot agree, for I can see no reason, on general pathological principles, why an ulcer which secretes an infectious virus, as the soft chancre is well known to do, should be capable of inoculating certain tissues and not others; why, in other words, it should be able to reproduce itself locally, and yet not be able to affect, implicate, or contaminate the constitution. To assume the possibility of such an occurrence would be, as has been remarked elsewhere, to suppose that there are two distinct poisons, a view which is contrary to all reason, science, and analogy, and which is therefore altogether untenable. But the observant practitioner is not driven to the adoption of so absurd a conclusion; he appeals to his personal experience, and is satisfied that he has repeatedly seen the very worst cases of secondary symptoms succeed to the soft chancre. I am sure it has repeatedly fallen to my lot to witness such effects, and I cannot therefore but regard this doctrine as a most pernicious one, calculated as it is, if practically followed, to throw the surgeon off his guard, and thus prevent him from adopting a suitable treatment for the relief of his patient.

Secondary symptoms often come on before the primary affection has disappeared; a chancre, indeed, may, so to speak, be in full bloom, and continue to furnish an abundance of specific virus, and yet the constitutional disease have already made considerable progress, the skin being perhaps covered with eruptions, the throat inflamed or ulcerated, and the tongue affected with tubercles, thus showing thorough contamination both of the solids and fluids. Or, the chancre may have become cicatrized, but remain hard and tender, more or less of the specific poison lurking in the affected tissues, ready to ferment and break out anew from the most trivial causes. Or, the original sore may have got entirely well, but the bubo be still in action, either as an indurated swelling, or as an ulcer with more or less discharge. Or, lastly, and as is perhaps most commonly the case, the secondary complaint does not display itself until some time after the primary has completely disappeared, and the patient has perhaps imagined himself perfectly well.

It is generally impossible to determine, in advance, what effect a chancre may exert upon the system; or, in other words, whether or not it will be likely to lead to constitutional contamination. There are certain circumstances, however, which, like coming events, cast their shadow before them, and thus serve to enable the attendant to

form at least a plausible conjecture, if not a probable conclusion, in respect to the future condition of the system. These circumstances may be arranged under the following heads:—

1st. It is now generally, if not universally, admitted that the indurated chancre is nearly always followed by secondary symptoms; often, if not usually, coming on before the primary sore is completely healed, and producing a degree of contamination which it is extremely difficult, if not impossible, to eradicate completely from the system. The constitution, once affected, nearly always retains the peculiar impress which it has received from the virus, in so much that the disease is probably capable of being propagated from parent to offspring during a series of generations.

2d. The non-indurated chancre, if multiple or of great extent, will, other things being equal, be more likely to give rise to constitutional involvement than a single sore, especially if superficial and of small size.

3d. The site of the chancre probably exerts some influence upon the production of secondary symptoms. Thus, there is reason to believe that a specific ulcer seated upon the inner surface of the prepuce, or at the free border of this muco-cutaneous fold, will be more likely to lead to contamination of the system than a chancre on the head of the penis, owing probably to the greater activity of the absorbent vessels in the former than in the latter. A chancre of the urethra is rarely followed by constitutional infection.

4th. Constitutional involvement is also influenced by the duration of the chancre. It has been conclusively shown that if a chancre, even if it pertain to the indurated variety, be cured or removed before the end of the fifth day from the time of the inoculation, there is, as a general rule, no risk whatever of systemic contamination; and it is perfectly reasonable to suppose that the chances of absorption of the specific virus will be much diminished, in every case, whatever may be the nature or site of the sore, in proportion to the shortness of its duration. Hence the absolute importance of getting rid of such a sore in the most summary and thorough manner.

5th. The state of the patient's health greatly influences the production of secondary syphilis. If he be stout and robust, and, in every respect, well conditioned, both as it concerns his solids and fluids, the poison will be much less likely to be conveyed into the system than if he be feeble and exhausted by disease, or laboring under a strumous or scorbutic cachexia.

6th. The kind of treatment also produces a marked effect upon the occurrence of a syphilitic diathesis. There is no doubt at all that, as a general rule, secondary symptoms are much more liable to declare themselves if mercury be given for the primary disease than when the cure is accomplished without it. The results of upwards of 80,000 cases, treated by the simple method in various parts of the world, conclusively establish this fact.

7th. The degree and character of the inflammatory action accompanying the chancre often greatly influence the occurrence or non-occurrence of constitutional symptoms. When the inflammation is

unusually severe, or of a highly phagedenic type, absorption will be kept in abeyance, and the system escape contamination. Gangrene, supervening early in the progress of the chancre, always prevents the absorption of the specific virus.

Finally, it is not improbable that the occurrence of secondary accidents is materially influenced by individual peculiarity or idiosyncrasy. It is well known that some persons contract primary syphilis with great difficulty, and, on the other hand, there are some who can never touch an infected female without being inoculated. The same is true of secondary syphilis. Thus, one man whose penis is literally covered with chancres may escape constitutional contamination entirely, while another, who has only a small sore precisely of the same kind, may suffer very severely. There must be great individual peculiarities in regard to the susceptibilities to the action of this poison, otherwise it would be impossible to account for the remarkable diversities which characterize the evolution and course of this disease in different persons.

Secondary syphilis is not *contagious*, thus showing that the specific virus, after it has fully entered the system, undergoes changes which essentially modify its properties and disqualify it for the production of an inoculable disease. I am aware that a contrary opinion has been held by some very eminent authorities, and that the experiments of Vidal, Cazenave, and others, with the pus of syphilitic ecthyma, would seem to countenance such a view; but it is impossible not to believe that these distinguished syphilographers, in their zeal to promote the interests of science, were deceived by accidental circumstances connected with the state of the system of those who were the subjects of their researches, causing it to give rise to an appearance similar to, but by no means identical with, that of a chancre or an infectious pustule. Indeed, if such an occurrence were possible it would manifest itself constantly during the progress of secondary syphilis in consequence of the secretions coming in contact with raw surfaces upon the skin and mucous membranes.

But, although secondary syphilis is not contagious, yet it is *transmissible* from the parent to the offspring, probably not merely through one but through many generations, the result declaring itself in a great variety of affections, and often proving destructive to the new being, sometimes before birth and other times not until afterwards. The very stream of life is poisoned, and all those who partake of it are destined to suffer from its effects, this being at least one way in which "God visits the iniquity of the fathers on their children, down to the third and fourth generation." The very fact that the disease is transmissible shows that the whole system of the individual is impregnated with the specific poison, every globule of blood and every particle of solid matter being impressed by it. It is this pervasive, universal influence that has led to the opinion, now very general on the part of the best educated members of the profession, that constitutional syphilis is seldom, if ever, completely eradicable. Once planted in the system, its germ is probably indestructible.

Secondary syphilis is usually ushered in by well-marked *constitu-*

tional phenomena. Generally some days—frequently as many as eight or ten—before there is any evident local disease, the patient feels conscious that he is unwell, or that there is something wrong about him; he is in a state of *malaise*, or in that uncomfortable condition in which a man is neither well nor yet decidedly sick. Prominent among these symptoms is his mental dejection; he is gloomy and desponding, indulging in unpleasant forebodings, and unable to apply himself to business; his countenance assumes a dull, muddy appearance; his hair becomes dry and rough; his limbs and joints feel sore and stiff; his appetite is indifferent; the bowels are inclined to be costive; the urine is scanty and high-colored; exercise soon fatigues; and the sleep, disturbed by frequent dreams, is unrefreshing. Gradually, after the lapse of a few days, or, it may be, all of a sudden, the patient is seized with chilly sensations, or actual rigors, followed by high fever, or by fever and profuse sweats. The attack, which constitutes what is called *syphilitic fever*, is manifestly an effort of the system to eliminate the specific poison, and the tissues upon which it usually explodes are, as was previously stated, the cutaneous and mucous, together with the posterior cervical ganglions, the morbid phenomena of the former exhibiting themselves in various eruptions, and of the latter in ulcers of the throat and tubercles of the tongue. The iris may also be enumerated as liable to suffer from secondary involvement.

2. AFFECTIONS OF THE SKIN.

The syphilitic affections of the skin, the *syphilides*, as they have been termed by Alibert, manifest themselves under at least six varieties of form, the exanthematous, scaly, vesicular, pustular, tubercular, and papular. Of these, however, the last three, in consequence of the lateness of their appearance and the severity of their character, may be regarded rather as appertaining to the tertiary order of phenomena than to the secondary. Of the other three, two are not unfrequently coincident with the primary disease, although, in general, they do not show themselves until some time afterwards. The syphilitic eruptions nearly always pursue a chronic course, are more or less circular in their form, and always exhibit a characteristic copper color, especially in their earlier stages; for, after they have existed for some time, they are very apt to assume a grayish, muddy, or bronze appearance, owing to some modification in the coloring matter of the skin. Although occurring upon all parts of the cutaneous surface, they are usually most conspicuous upon the forehead, nose, cheek, back, and shoulder, together with the inside of the arm and thigh, and are followed or attended by thin, grayish scales, hard, thick, greenish scabs, narrow, superficial cracks, or well-marked ulcers.

Syphilitic cutaneous diseases can generally be easily distinguished from ordinary skin diseases; first, by the history of the case, especially the existence or absence of chancre; secondly, by the concurrence of lesions of the cutaneous and mucous textures; thirdly, by the copper color of the affected surface, the eruption, scale, or pustule being itself either of that complexion, or surrounded by a more or less dis-

tinctly defined border of it; and, lastly, by the total absence of itching in syphilitic affections, whereas that symptom is of very common occurrence in ordinary cutaneous maladies.

1. In the *exanthematous* form, the spots are of a dark copper color, of a circular shape, and from the size of a dime to that of a twenty-five cent piece, the intervening surface being of a muddy, dusky aspect. Although they sometimes cover nearly the whole body, yet they are generally most prominent on the trunk and extremities; they are never confluent, do not disappear under pressure, and usually pass off with a slight desquamation of the cuticle. There is a variety of this eruption in which the spots are of much smaller size, more irregular in shape, and of a brighter red, the color resembling that of a new copper coin. From this circumstance, and from the eruption being often somewhat confluent, like measles, it is generally known by the name of *roseola*. In neither of these forms is there any actual elevation of the skin.

The syphilitic exantheme often comes on before the disappearance of the primary disease, sometimes suddenly, and without any decided premonitory symptoms; at other times gradually, and with considerable pyrexial disturbance. As the eruption fades it loses its reddish tint, and assumes a dingy, dirty, dusky, or grayish aspect. Its duration varies from ten days to three or four weeks. Its gradual disappearance, and its coincidence with chancre, bubo, cervical adenitis, and other marks of syphilis, either primary or secondary, together with the absence of local distress, as itching and smarting, readily distinguish it from measles and other cutaneous affections.

2. The *scaly* variety of syphilis generally appears without any febrile disturbance, at a period varying from six to ten weeks after the primary disease; it is always remarkably chronic, lasting frequently for months together, and is commonly associated with ulceration of the throat and palate, iritis, and affections of the bones and joints; forming, in this case, a kind of connecting link between the secondary and tertiary stages of the constitutional malady.

The eruption manifests itself, as the name implies, in distinct scales, or thick and hardened portions of epidermis, of a dull, opaque, grayish appearance, resting upon a copper-colored base. It generally appears in separate patches, which, although they may occur on all parts of the cutaneous surface, are, nevertheless, most common on the forehead, scalp, face, forearms, palm of the hand, and sole of the foot, in the latter of which they often acquire a remarkable thickness. Each individual spot is from three to twelve lines in diameter, of a rounded shape, ordinarily isolated, rough, and somewhat elevated beyond the adjoining level. The scale is hard, whitish or grayish, and slightly adherent; the skin underneath has a tendency to ulcerate, or to form cracks and fissures, and when, by this means, its integrity is destroyed, the affected surface becomes covered with a thick, dry, brownish crust. When the part has cicatrized, a whitish spot, somewhat depressed at the centre, marks the original site of the disease.

3. The *vesicular* variety of syphilitic disease is of very uncommon occurrence; it is, in fact, by far the rarest of all the syphilides. It

usually begins, coincidently with the latter stages of the primary sore, or soon afterwards, in minute, circumscribed pimples, scattered over different parts of the body, to which soon succeed small vesicles, occupied by a transparent, serous fluid, and surrounded by a reddish, copper-colored areola. Their progress is slow, and their contents are either absorbed, or they harden into thin scales, or scabs, which, falling off at different intervals, leave the part of a dingy, yellowish hue. The vesicles sometimes show themselves in distinct groups, and occasionally, though rarely, they are so numerous as to cover nearly the whole surface of the body. In general, they are most common on the neck, chest, and extremities, especially the superior, their occurrence on the face and head being very infrequent. They usually coincide with syphilitic disease of the throat, and nomadic pains in the bones and joints; a circumstance which, together with their copper-colored base, readily distinguishes them from ordinary vesicles.

4. Syphilitic *pustules* consist of circumscribed elevations of the skin, occupied by pus, or sero-purulent matter, and possessing a strong tendency to terminate in ulceration. Although they occasionally co-exist with the primary disease, yet they rarely appear until a long time after, and therefore generally appertain to the third order of symptoms, their presence being always denotive of profound constitutional contamination. Their size and figure are subject to considerable diversity. Sometimes they are as large as a hazel-nut; but ordinarily they do not exceed the volume of a pea, and in many cases they do not attain even that size. In their shape they are conical, oval, pyriform, rounded, or flattened, with a minute central depression; and there are few instances in which these different varieties do not co-exist. Their number is often immense, hundreds being scattered over a small extent of surface; and, as they form successively, they may be seen and studied in every stage of their development. Each pustule reposes upon a hard, copper-colored base, and is apparently of a very complex structure, though its precise character is undetermined.

After remaining for a short time, the contents of the pustule escape, concrete, and form hard, thick scabs, of a dark color, pretty firmly adherent, and sometimes circularly furrowed. In the more simple cases, the scabs soon fall off, leaving merely a chronic induration, a livid, dusky, or grayish stain, or a small cicatrice; in the more severe forms of the disease, on the contrary, deep, circular, characteristic ulcers are exposed, with a foul, grayish bottom, and a hard, purple, and well defined margin. In cases of the latter description, the scabs are frequently renewed, and are finally succeeded by round, indelible scars.

There are two varieties of syphilitic pustules, the one, termed the phydracious, occurring in groups, and the other, the phlyzacious, disposed separately, without any tendency, as is sometimes the case with the other, to become confluent. Willan and some other dermatologists have described them under the generic appellation of syphilitic ecthyma. It is the matter furnished by these pustules that has been erroneously supposed by Vidal, Cazenave, and a few other observers, to be capable of transmitting secondary syphilis by inoculation.

The pustular form of syphilis is not unfrequently associated with the tubercular and papular, but rarely with the roseolar and squamous. Severe constitutional disturbance is generally present, and, indeed, the suffering may be so great as to destroy life, the health being gradually undermined by the excessive pain and irritation of the eruption and its sequelæ.

5. In the *tubercular* variety of syphilis, the most formidable, if not also the most frequent of all, the eruption consists of small, red, copper-colored eminences, varying in size between that of a mustard-seed and an olive. Of a rounded, flattened, or conoidal shape, they are either isolated, assembled in groups, or arranged in perfect circles; they are smooth and polished, produce little or no pain, and become covered, in a short time, with a dry, scaly incrustation, which is generally reproduced as fast as it falls off.

In the more aggravated forms of this variety of syphilis, the tubercles are inordinately large, prominent, of a deep violet hue, from three to six lines in length, and encircled by a well-marked, copper-colored areola. After continuing thus for some time, varying from a few months to several years, they become painful, inflame, suppurate, and are replaced by deep, foul, irregular ulcers, reposing upon a hard, purple base. A thick scab usually covers these erosions, which is repeatedly renewed, showing, each time it is detached, that the sore is extending its ravages. When the tubercles are numerous, the ulcers, running together, often acquire a frightful size, and, on healing, leave disfiguring cicatrices.

6. *Papular* syphilis is characterized by the occurrence of small, hard, solid elevations, containing no fluid, and terminating almost always in desquamation, seldom in ulceration, or in the formation of scabs. There are two varieties of the affection, one of which is acute and primary, the other chronic and secondary.

In the first variety, the eruption appears simultaneously on different regions of the body, and is completed in about forty-eight hours from the time of its first invasion. The papulæ are extremely small, disjoined, or grouped, of a red copper color, and of a slightly conical shape, being surrounded, here and there, by violet areolæ, which are often confluent, and give the surface a characteristic yellow tinge. Ulceration rarely attacks these papulæ; they disappear in a short time, and are followed by a furfuraceous desquamation of the cuticle.

In the other variety, the eruption is developed in a slow and successive manner, being announced by small yellow spots, which are particularly numerous on the forehead, scalp, and extremities. The papulæ, which are of a light copper color, are larger than the preceding, flat, of the size of small beans, grouped, and devoid of an areola. In time, the summit of each elevation becomes covered with a dry, grayish pellicle, which is regenerated as fast as it desquamates, until the disease finally entirely subsides. Meanwhile, the skin between the agglomerated papulæ undergoes important changes; it assumes a dingy yellowish color, has a dry, shrivelled aspect, and is the seat of a constant exfoliation of the cuticle.

Treatment.—The treatment of secondary cutaneous syphilis may be divided into common and specific, the first being of a general antiphlogistic character, while the second has for its object the neutralization or destruction of the virus upon whose action the affection more particularly depends, and which, so long as it continues, exposes the system constantly to new outbreaks of the disease. I have found it advantageous, even as a general rule, to begin the treatment with antiphlogistic remedies; for, although they may not always, or perhaps even very frequently, eradicate the poison, yet it is unquestionably true that the salutary impression which they make upon the system, by ridding it of its impurities, and restoring the secretions, greatly paves the way for the more prompt and efficient operation of any specific measures that may afterwards be deemed advisable. A disregard of this rule is probably one of the chief reasons why the mercurial treatment of syphilis is so often followed by severe tertiary symptoms, the system not being properly prepared, by a course of dieting, baths, purgatives, and other remedies, for the reception and beneficial action of the mineral.

Syphilitic fever should be combated upon the same general principles as any other kind of sympathetic fever. If the symptoms run high, as indicated by the state of the pulse and skin, and the patient is young and plethoric, blood may be taken from the arm, and the saline and antimonial mixture be directed, the bowels having been previously opened by a brisk cathartic. The action of the medicine should be promoted with tepid drinks, and, if there be much pain and aching in the back and limbs, a Dover's powder, or an anodyne and diaphoretic draught will probably be necessary. The duration of the fever is usually very short, the disease often yielding to very simple measures.

When eruptions appear upon the skin, the treatment which I usually adopt is the *antimonial*, having found it to answer an excellent purpose in a great majority of the cases of the disease that have fallen under my observation. The quantity of tartar emetic to be given at each dose must vary from the fourth to the eighth of a grain, repeated every three, four or five hours, according to the effect of the remedy, decided nausea being hardly desired under any circumstances. What the practitioner wants to produce is the sedative and alterant effects of the medicine. It may be administered by itself, as in the milder forms of secondary cutaneous affections, or be variously combined with other articles, as sulphate of magnesia, when there is constipation, aconite, when there is much arterial excitement, or morphine when an anodyne and diaphoretic action is desired. The salutary operation of the medicine will be greatly promoted by the daily use of the tepid bath, by diluent drinks, and by the strict observance of the antiphlogistic regimen.

How tartrate of antimony and potassa acts in producing its salutary effects in secondary syphilis of the skin has not been determined. It is not improbable, I think, that it may, as mercury is supposed to do, neutralize the poison of the disease, by divesting it of its zymotic qualities; or it may act simply as an eliminator, by furnishing an

outlet for the poison through the various emunctories, upon all of which this medicine is known to exert more or less influence.

Tartarized antimony, then, according to my experience, is the great remedy upon which our reliance is mainly to be placed in the treatment of secondary syphilis, especially of the skin, and, also, although in a less degree, of the mucous membrane. If the remedy fail, or the disease prove rebellious, recourse must be had to mercury, given in the same manner, and with the same restrictions, as in the primary form of the disease. The use of this remedy may, I am satisfied, be limited to a very narrow circle of cases of secondary syphilis, and it will be found that, whenever it becomes necessary, its action will always be immensely promoted by the previous employment of tartar emetic.

3. ALOPECIA.

During the progress of syphilis it occasionally happens that the hair of the scalp falls off, constituting what is technically called alopecia. The accident generally comes on within the first six or eight weeks from the appearance of the primary sore, with which, consequently, it is not unfrequently coincident, and usually occurs in circular discs, of variable size, and of a well-marked copper color, similar to the eruptive syphilides. The affection is commonly partial, showing itself, as just stated, in distinct patches, of which several may exist simultaneously, or as fast as one gets well another may succeed, and thus the affection may proceed until it has travelled over the greater portion of the scalp; or, instead of this, nearly all the bulbs may suffer at once, and the hair drop off in great numbers, leaving the head ultimately nearly completely bare. When the system is, as it were, saturated with the specific virus, not only the hair of the scalp, but also of the beard, the eyebrows, and the rest of the body may drop off. I have seen two well-marked cases of this universal alopecia, both occurring in young men who had been the subject of indurated chancre upon the head of the penis; in one the desquamation was associated with roseola and sore throat, and was never followed by a reproduction of hair anywhere. The patient, after having lingered for several years under the exhausting effects of rupia and nodes, died in a state of marasmus. In the other case, the alopecia was succeeded by syphilitic sarcocele; and in this the hair, in time, was regenerated upon the scalp, although it always remained stunted in its growth, and was remarkably coarse, stiff, and sparse.

The first sign of baldness usually consists in a loss of the soft and glossy state of the hair, which becomes dry, stiff, and brittle, breaking off very easily in combing the head. After a little while it is observed to fall off in great abundance; and if the scalp be now examined it will be found to be remarkably harsh and scurfy, and to be covered with muddy, dingy, or dusky, copper-colored blotches, generally of a circular shape, and apparently, though not in reality, somewhat elevated above the adjoining surface. Fever occasionally accompanies the affection; and pains in the bones and joints, apparently of a rheu-

matic nature, generally characterize the progress of the case. Regeneration of the hair, partial or complete, may usually be expected, even under apparently the most adverse circumstances.

Baldness, as an effect of syphilis, is a grave occurrence, and the practitioner cannot be too eager in his attempts to arrest it. The first thing to be done is to cut off the hair, not too closely, but just sufficiently to admit of the requisite attention to cleanliness and medication. Shaving of the scalp is not necessary in any case, however severe. The treatment, directed more especially to the relief of the diseased hair-bulbs, must be essentially of a stimulating character, calculated to impart tone and vigor to the whole of the affected surface. In the more simple cases mild lotions of alcohol and spirits of hartshorn, eau de Cologne and compound spirits of lavender, or alcohol, castor oil, and tincture of cantharides, either in equal, or in different proportions, may be used, according to the desired strength of the particular preparation. Another excellent wash is a solution of tannin and sulphate of copper in equal parts of spirits of wine and water, six grains of the former, and half a grain of the latter being used to the ounce of fluid. The application should be made twice in the twenty-four hours, the friction being performed with the hand and fingers, and steadily continued until there is a glow upon the surface. The scalp should be washed every morning with warm water and Castile soap, and well combed immediately after to promote cleanliness and dislodge dandriff.

If soreness of the scalp exist, or if there be eruptions, papules, tubercles, or numerous dry and adherent scales, the most eligible application will be a pomade of simple cerate and of the ointment of the nitrate of mercury, in the proportion of seven parts of the former to one of the latter, mixed with a few drops of the oil of jasmine and a little Cologne water, and thoroughly rubbed into the roots of the hair night and morning. Along with these means special attention should be paid to the state of the system, and if the case bids fair to be obstinate, or if the alopecia coexist with an indurated, indolent, or badly-healed chancre, measures should be adopted to bring the patient as promptly as possible under the gentle influence of mercury.

4. CERVICAL ADENITIS.

The posterior cervical ganglions generally suffer at an early period of the constitutional involvement, becoming enlarged and somewhat tender, though never very painful, and rolling, when pressed upon with the finger, like so many little elastic balls under the integuments. The swelling is generally most conspicuous in the glands which are situated just below the junction of the occiput with the vertebral column, or at the root of the hairy scalp, and frequently extends as far outward on each side as the mastoid process. It is essentially of a chronic nature, often lingering for many weeks, and never terminating in suppuration. Diagnostically considered, this species of adenitis, from the constancy of its presence, is of great value, but from the want of practical tact to detect it, it is extremely liable to be overlooked by

the surgeon. Its occurrence is most common in young subjects, and it occasionally manifests itself at so late a period of the disease that it may then be considered rather as belonging to the tertiary than to the secondary order of symptoms.

Cervical adenitis generally readily disappears under the treatment directed for the relief of other secondary affections. The enlarged glands may be rubbed twice a day with ammoniated liniment, or painted with dilute tincture of iodine. If much induration exist, the most eligible remedy will be gentle mercurial inunction.

5. AFFECTIONS OF THE MUCOUS MEMBRANES.

Secondary syphilis of the mucous membranes generally declares itself within a short time after the cure of the primary sore, and sometimes even before this has completely disappeared; existing at one time in association with secondary affections of the skin, and at another, and perhaps more commonly, independently of them. From four to eight weeks is the average period of the evolution of the disease when it attacks these structures. What strikes one as very remarkable is the extent of surface over which it may spread, there being no visible portion of the mucous membranes where it has not been observed. The parts, however, which are most prone to suffer are the tonsils, palate, pharynx, tongue, cheeks and lips. It rarely extends into the windpipe. No dissections of a satisfactory nature have been made tending to show that the lining membrane of the stomach and bowels ever participates in the morbid action, but it is certain that well-marked signs of the malady have been repeatedly witnessed at the anus, as high up as the first inch or inch and a half from its verge, and of such a character as to be altogether unmistakable. In the male they sometimes appear upon the foreskin and head of the penis, while in the other sex they are liable to occur upon the vulva, the vagina and uterus. Their presence has not been detected in the respiratory and urinary organs, and is therefore altogether a matter of conjecture, only to be settled by future observation. From the remarkable relations existing between the skin and mucous membranes, and the fact that syphilitic affections of the former are liable to occur in all parts of its extent, it is not improbable that the latter may suffer in the same manner, though perhaps not in an equal degree, some portions almost entirely escaping, while others are peculiarly prone to receive and harbor the specific virus.

Secondary affections of the mucous tissues occur in various forms; at one time, or in one place, as an erythematous disease, at another, as an elevation or tubercle, and again as a distinct ulcer, crack, or fissure; depending, doubtless, upon some peculiar modification of the structure of the suffering part, some change in the action of the poison, or some idiosyncrasy of the individual. In the mouth and throat, where these affections are most common, it is not unusual to notice their coexistence, mere inflammatory redness with or without plastic deposit going on at one point, ulceration at another, and the formation of a tubercle at a third.

Syphilitic *erythema* is observed chiefly in the throat, affecting the arches of the palate, tonsils, uvula, pharynx, and perhaps the root of the tongue. In rare cases it extends to the roof of the mouth. It may present itself as a diffused inflammation, or in the form of distinct patches, generally of a circular or oval figure, and from the size of a gold dollar to that of a twenty-five cent piece, the intervening surface being apparently quite healthy. The color, in the early stage of the disease, resembles that of a new copper coin, but it gradually loses its bright, fiery hue, shading off into dark bronze, in proportion as the morbid action declines. In cases of long standing and unusual severity, the discoloration is of a deep flesh-color and conjoined with marked thickening of the mucous membrane, and a tendency to ulceration. Deposits of lymph are not uncommon upon the inflamed surface, even when the disease is not at all active; occurring in small aphthous-looking specks, in considerable-sized patches, or in circular rings, more or less firmly adherent, and of a pale orange tint.

This affection, which bears the closest resemblance to erythema of the skin, generally exists without the consciousness of the patient; there being no soreness in the throat or difficulty of deglutition, and no constitutional disturbance. All is quiet and passive, and the disease is perhaps discovered altogether by accident. It of course denotes only a very slight taint of the system. It is apt to appear within the first four or five weeks after the primary sore, and consequently not unfrequently before this is healed.

Ulcers of the throat assume various appearances, and involve different structures; but particularly the tonsils and the back of the pharynx, affecting these parts either separately or conjointly. They occur principally in two varieties of form, the excavated and superficial.

The excavated ulcer looks, as the name denotes, as if it had been made with a punch, or dug out of the tissues with a spade. Its edges are steep, everted, and ragged, like those of the Hunterian chancre; and they are surrounded by a hard, inflammatory, copper-colored base. The surface is usually incrusted with greenish, muddy or yellowish lymph, which gives it a foul, unhealthy aspect. The discharge is thin and ichorous. The excavated sore is always most distinctly marked on the tonsils, where it sometimes acquires an immense size, and is generally accompanied by extensive inflammation of the surrounding parts. It is often seen during the progress of the primary disease, especially the indurated chancre, and is liable to be associated with some of the earlier forms of cutaneous eruptions, particularly the exanthematous and scaly.

The superficial ulcer is often multiple, several frequently occurring together, either in close proximity, or scattered over the inflamed surface. Its appearance is either that of an abrasion, or of a cavity with well-defined, ragged edges, rather sharp, and often somewhat undermined; its surface being covered with a white or yellowish tenacious and adherent lymph: the parts around, although red and irritated, are free from induration. The most common sites of this variety of sore, which now and then assumes a serpiginous character, are the arches of the palate, uvula, and pharynx. It generally comes on early after the

absorption of the specific virus, and often coexists with the primary sore.

Secondary syphilitic ulcers of the throat are liable to take on phagedenic and gangrenous action, in the same manner as primary sores, and apparently from similar causes, the state of the system and mode of life of the patient mainly contributing to change their character. In consequence of the superaddition of this action, extensive destruction of the soft palate may result, followed by difficulty of deglutition and important alterations of the voice. Ordinary syphilitic ulceration of the throat, even when considerable, is not always attended by well marked local and constitutional symptoms; the disease, in fact, is often remarkably insidious in its approaches, and may therefore have made great progress before its presence is even suspected. The excavated form of the affection is generally accompanied with extensive swelling, pain and difficulty in swallowing, and more or less febrile disturbance. When the tonsils are the seat of the lesion the tumefaction may be so great as to cause serious obstruction to respiration.

Small ulcers, crevices, and fissures, of a secondary nature, are sometimes met with on the lips, especially at the corners of the mouth, the inside of the cheeks, and the tongue; generally superficial, indisposed to spread, and attended with but little uneasiness and discharge. Occasionally they have abrupt edges and a hardened base. Their diagnosis must necessarily be difficult, the only reliable sign being their coexistence with other marks of syphilis, either primary or consecutive.

Mucous *tubercles* are most commonly found upon the tongue, the lips, and the inside of the cheeks, where they occur as slight elevations of the mucous surface, generally of an irregular oval or elongated shape, and of a whitish hue, as if the secretion of the part had been discolored with nitrate of silver or partially coagulated albumen. Upon taking hold of the swelling with the thumb and finger it is felt to be more or less hard, not unlike an indurated chancre, and is generally quite tolerant of manipulation, even firm pressure rarely causing any decided pain. The size of the spots is variable, ranging from that of a pea up to that of a twenty-five cent piece; they sometimes exist in considerable numbers, and when this is the case they occasionally become confluent. If permitted to go on unrestrained, they may give rise to ulceration, generally of a deep, excavated character, the edges of the sore being steep and callous.

This variety of syphilitic affection finds its analogy in the condylomatous excrescences which are so liable to form about the anus and perineum, in consequence of the action of the syphilitic virus. As it usually comes on without any pain, its discovery is often due purely to accident. The most reliable diagnostics are the peculiar color and feel of the affected part, which, so far as I know, are not noticed in any other kind of disease, and the coexistence of syphilis in other localities, particularly the throat and skin. Not unfrequently traces of the primary disease will be found either in an open sore, or in the indurated cicatrice of a recently healed chancre.

Treatment.—These mucous affections being all of a kindred character, their treatment must be conducted upon the same general principles.

If the patient be at all plethoric, antiphlogistics will probably be necessary, blood being taken either by the lancet or by leeches from the vicinity of the inflamed parts, and the depletion followed by active purgation and the use of the antimonial and saline mixture, rendered anodyne and diaphoretic by the addition, to each dose, of a small quantity of morphia. Light diet and perfect quietude are enjoined. In the milder cases of these diseases the most simple constitutional means will generally suffice, no drain upon the system of any kind being necessary. The most suitable local remedies are nitrate of silver, acid nitrate of mercury, and nitric acid, either pure, or variously diluted, and applied at longer or shorter intervals, according to the exigencies of each particular case. The solid lunar caustic is generally to be preferred when there is no breach of continuity, the affected surface being touched with great care and gentleness once every forty-eight hours, some mildly astringent gargle, or simple mucilaginous fluid being employed in the intervals. When the part is ulcerated the caustic must be used more boldly, as well as oftener; though, under such circumstances, I usually give a decided preference to the acid nitrate of mercury, applied by means of a stick of soft wood, the end of which, being well rounded off, enables us to deposit just enough and not any too much of the fluid, as is so apt to happen when we employ a mop. Not only the sore but also the inflamed surface around should be treated in this way, and the application, in bad cases, should be regularly repeated every twenty-four hours until there is a very decided improvement in the disease. My experience teaches me that hardly any secondary ulcer of the throat, palate, or tongue can withstand such a remedy beyond six or eight days, while in many cases it yields in a much shorter time. As soon as the reparative process begins the acid is used less frequently and in a more dilute state. When the acid nitrate is not at hand, a good substitute will be furnished by nitric acid.

The gargle which I usually prefer in ulcerated sore throat is the pyroligneous acid, in the proportion of about one drachm to half a pint of water, well sweetened with honey, and used five or six times in the twenty-four hours. Weak solutions of subacetate of copper and tannin, of nitric acid, and of chlorinate of soda also answer an excellent purpose.

Mucous tubercles generally yield to a few applications of the solid nitrate of silver, aided by astringent gargles, suitable purgation, and light diet. Similar means will usually suffice for the cure of superficial abrasions, excoriations, and fissures of the lips and cheek.

Mercurialization only becomes necessary in particular cases. In general, the remedy is called for when there is an excavated ulcer, or an ulcer possessing an extraordinary degree of indolence, or indolence and induration. The simple, superficial sore rarely requires such a remedy; and it is of course withheld when there is a tendency to phagedena or gangrene in a broken, anemic state of the system. Under such circumstances tonics, a generous diet, and nutritious drinks take the place of the mineral.

SECT. IV.—TERTIARY SYPHILIS.

1. GENERAL CONSIDERATIONS.

When the specific poison has deeply penetrated the system, and become, as it were, inlaid in its different structures, as well as thoroughly commingled with the blood, the effects which it produces constitute what is denominated tertiary syphilis, an order of sequence first distinctly asserted by Ricord, and now generally recognized by surgical teachers. The boundary line, however, between the secondary and tertiary groups of phenomena is not always well defined, the former affections often running, by gradual and insensible gradations, into the latter; an occurrence which cannot be too strongly impressed upon the mind of the reader, on account of the great practical importance of the subject. It is generally understood that those symptoms of the disease which show themselves before the fifth or sixth month from the commencement of the primary sore should be classed under the head of "secondary syphilis," while those which come on subsequently, or after this period, are considered as appertaining to the third order of phenomena, or "tertiary syphilis," the average period of their evolution ranging from six to eighteen months, although in very many instances they do not occur until a number of years after the appearance of chancre, or chancre and bubo. Thus, I have repeatedly seen tertiary symptoms manifest themselves, for the first time, from twelve to eighteen years after the primary disease, the poison having lain all this time, like a hidden spark, in the economy. Once fairly roused, however, into activity, it extends through the system with great rapidity, completely overwhelming it in its progress, and exploding, with peculiar force, upon certain tissues, textures, or organs, these structures having apparently a kind of elective affinity for it.

The textures which are particularly prone to suffer in tertiary syphilis are the skin, mucous membranes, periosteum, bones, fibro-cartilages, aponeuroses, tendons, and testicles. All parts of the economy, however, are involved in the contamination, and it is extremely probable that, in the worst cases, hardly any organ or structure entirely escapes. The affections of the internal viscera, however, although alluded to by many of the older syphilographers, have only of late attracted serious attention, and hence the amount and nature of their participation in this poisoning process have not been satisfactorily ascertained. Enough, however, has been determined to produce conviction that the changes in the lungs, brain, heart, liver, and other organs are often of a grave character, liable to be followed by the worst results, because so insidious are their approaches and progress that even their existence is hardly ever suspected during life, to say nothing of the impossibility of arresting them by any known treatment, or combination of remedies. The most common of these internal lesions, which have, strangely enough, been termed secondary, are foul, ragged looking abscesses, with imperfectly elaborated contents, softening and pulpy degeneration, and tubercular deposits. Attention has not

yet been sufficiently directed to the alterations of the ovaries of females who die of tertiary syphilis; but from the resemblance which exists between these organs and the testes, both in structure and function, and from the fact that the latter are so often involved in the disease, it is highly probable that it will be found, as our pathological researches are extended, that they frequently seriously participate in the morbid action.

Tertiary syphilis is not invariably preceded by secondary symptoms; on the contrary, there are many cases where the disease passes directly from the first to the third order of phenomena, the structures usually implicated in the secondary attack escaping entirely. Again, it is well known that tertiary syphilis is not always preceded by bubo.

Tertiary symptoms are most liable to occur in persons of intemperate habits, and of a broken, dilapidated constitution, with an impoverished state of the blood. A scrofulous, or scorbutic condition of the system, also acts as a predisposing cause.

The nature of the chancre doubtless exerts considerable influence upon the production of the disease. Thus, there can be no hesitation in affirming that tertiary syphilis is more apt to follow an indurated than a non-indurated chancre. The duration of the primary disease is also to be taken into the account; it being reasonable to suppose that a chronic chancre, which retains its specific poison, will be more likely to give rise to constitutional syphilis than one that is acute or rapidly healed.

Finally, the occurrence of tertiary symptoms is influenced by the nature of the general treatment. It is well known, as stated elsewhere, that when the primary sore has been treated without mercury there is much less likelihood of the development of remote constitutional symptoms than when this remedy has been used, especially when its effects have been carried to an inordinate extent, as evinced by profuse salivation. The occurrence of tertiary syphilis, under such circumstances, is not only probable, but the chances are that, if it do break out, it will show itself in the very worst form, by establishing a sort of mercurio-syphilitic diathesis, which it is extremely difficult, if not impossible, to eradicate completely from the system.

The immediate development of tertiary syphilis is often remarkably influenced by the habits and state of health of the individual. It is impossible to say how long the specific virus might lie dormant in the system if the subject of it were entirely free from the prejudicial influences of surrounding agents. Exposure to cold is usually accused of being one of the most common exciting causes of the complaint, and yet it is notorious that the inhabitants of the South Sea Islands and other tropical regions are extraordinarily prone to all kinds of constitutional syphilis. There can be no doubt, however, that the poison is often fanned into activity by the hardships of our northern winters and by a residence in damp cellars, or moist, ill-ventilated, underground apartments, especially when this mode of life is conjoined with all kinds of dissipation and intemperance, loss of sleep, and an impoverished diet. Although it is extremely probable that no state of the system, however near it may approach to the normal standard,

can ever entirely prevent the development of tertiary syphilis, when once the poison has taken possession of it, yet there can be no doubt that an individual so circumstanced will, other things being equal, be much less likely to suffer than one who is differently situated, or who gives himself up to the unbridled indulgence of his passions.

The matter furnished by ulcers, abscesses, and suppurating surfaces, consequent upon tertiary syphilis, is not inoculable; the specific virus has been completely changed in its properties, and no case has ever occurred where it was capable of infecting the tissues of a healthy person by direct contact. It is also believed that the disease is not hereditarily transmissible; but, although this be true in the ordinary sense of the term, yet it is extremely probable that the offspring of such an individual are, if not actually imperfectly developed, naturally predisposed to various kinds of cachectic affections, particularly to scrofula and scurvy, by which life is rendered miserable and often cut off prematurely, the constitution being unable to endure the hardships incident to ordinary pursuits.

The *prognosis* of this form of syphilis is always grave. Whatever form it may assume, it is extremely difficult to dislodge it effectually from the system, or to effect a radical, permanent cure. Relapses are of constant occurrence from the most trivial exposure, or the least disorder of the digestive organs, and few patients, however skilfully they may have been treated, are afterwards ever entirely free from rheumatic pains, proneness to cold, and stiffness of the joints. In fact, although recovery undoubtedly occasionally does take place, yet in most cases the constitution remains in an enfeebled and crippled condition, remarkably subject to attacks of other diseases.

Tertiary syphilis often proves fatal, although not nearly as frequently as prior to the discovery of the use of iodide of potassium, death generally occurring from local irritation and constitutional exhaustion. Many of those who recover are horribly disfigured, some from pock marks, some from the loss of the nose, and some from anchylosis of a joint.

2. SYPHILIS OF THE THROAT AND MOUTH.

Tertiary affections of the throat and mouth are by no means uncommon; they supervene at an indefinite period after chancre, and manifest themselves in characteristic ulcers, which, if permitted to go on undisturbed, gradually spread to the palate and maxillary bones, which, together with the soft parts, are sometimes destroyed to a most frightful extent, the buccal and nasal cavities being perhaps laid into one immense cavern. In some of these cases large portions of the alveolar process of the maxillary bone are necrosed, followed by the loss of many of the teeth, and a similar fate may be experienced by the ascending process and ungual bone, thus implicating and endangering the lachrymal sac and its canals. The nature of the disease is readily ascertained by ocular inspection and the altered state of the voice.

Tertiary syphilis of the *tongue* generally appears in the form of ulcers, or fissures, the latter of which are sometimes of enormous ex-

tent and depth, reaching far into the substance of the organ. Specific ulcers are usually situated upon the side of the tongue, at or near its middle, and exhibit the characteristic features of venereal sores in other structures, having a deep excavated form and a foul surface, with marked induration of the base, the parts feeling, on being pinched, like a mass of fibro-cartilage. Only one such cavity generally exists; when large and irritable, it may give rise to swelling of one of the lymphatic glands at the base of the jaw. The history of the case, the foul, excavated character of the sore, and the existence of syphilitic disease in the throat, nose, or other parts of the body, will always enable us to distinguish the lesion from other affections.

The following case will convey a good idea of the syphilitic fissure of the tongue: Frederick Saxe, a blacksmith, aged twenty-eight years, of Sullivan County, Pennsylvania, presented himself at the Clinic of the Jefferson College on the 8th of July, 1857. His tongue, which was of the natural length and breadth but much increased in thickness, and excessively hard at the sides, especially the left, was covered with numerous fissures, of varying size and depth, overhung by steep indurated edges, which at first sight concealed them almost completely from view. The largest groove, which resembled a deep furrow, extended along the centre of the organ, from a short distance in front of the root to within a few lines of the tip, its depth being nearly half an inch. The bottom of each fissure had a clean, smooth appearance; the mucous membrane of the tongue generally was somewhat redder than natural, but there was an entire absence of pain and even soreness under rough manipulation. The starting point of the disease seemed to have been the throat, which had been inflamed for a long time; the uvula had become elongated, and was obliged to be cut off weeks ago. The arches of the palate and tonsils were still a good deal discolored and congested. The tongue had been in its present condition for the last three months, having resisted various kinds of treatment, but the disease manifesting apparently no tendency to spread. A small painful node existed on the right tibia, and there was a vesicular eruption with some itching on the face. The man denied that he ever had syphilis, but the history of the case and his present condition clearly proved that he was mistaken, or tried to deceive me. He rapidly recovered under the internal use of iodide of potassium with bichloride of mercury, and the local application, every other day, of the solid nitrate of silver.

3. SYPHILIS OF THE NOSE.

Syphilitic disease of the nose, or syphilitic ozæna, as it is occasionally called, is another tertiary symptom, depending upon ulceration of the pituitary membrane, and the several bones of the nasal fossæ, including not unfrequently the proper bones of the nose. The morbid action, which is generally associated with marks of a constitutional taint in other situations, usually sets in at a very remote period after the primary sore, and lingers on, obstinately for many years, notwithstanding the best directed efforts to arrest it, until it has caused the

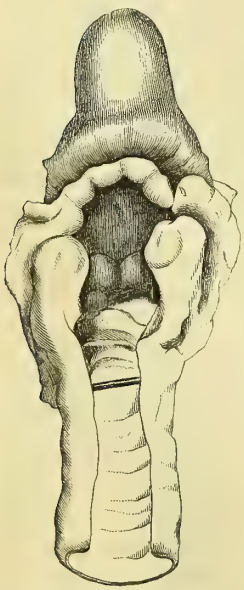
most extensive havoc, piece after piece dying and dropping off until every one has disappeared. When the proper nasal bones are involved the whole organ, bridge, cartilage and skin, may be destroyed. The disease is attended with an abundant fetid and bloody discharge, and the voice has a peculiar characteristic, muffled twang.

The septum of the nose is very prone to suffer in this form of syphilis, giving way, first, at the cartilaginous structure, and afterwards at the osseous. The consequence is that the part is perforated by an opening of variable size and shape, with sharp, irregular edges, which have a constant tendency to spread until the greater portion of the septum is effectually destroyed. A similar effect sometimes follows scrofula, and considerable difficulty may therefore attend the diagnosis. The chief points of distinction are the history of the case, and the fact that the ulcerative action is generally much more rapid in the former than in the latter disease.

4. SYPHILIS OF THE LARYNX.

Syphilis of the larynx seldom comes on until a long time after the primary disease, and may therefore justly be classed among the tertiary phenomena. In most cases, indeed, it does not declare itself before the end of the second year, and often not until much later. It is generally, but, I think, erroneously ascribed to an extension of disease from the palate, tonsils, and pharynx, by continuity of structure; instead of this being the case, I believe, on the contrary, that it is usually an independent affection, commencing in the larynx, and thence sometimes passing into the throat. However this may be, its coincidence with syphilis in other parts of the body, particularly of the skin, bones, and fibrous membranes, sufficiently stamps its character, and renders it easy of diagnosis.

Fig. 69.



Syphilitic ulceration of the larynx.

The disease, beginning in inflammation, soon terminates in ulceration, which often continues for months and even years together, the erosive action being at one time stationary, or on the very verge of healing, and at another steadily advancing. Confined originally to the mucous membrane, it at length invades the arytenoid cartilages, the vocal cords, and even some of the muscles of the larynx. Portions of the thyroid cartilage occasionally perish, and a not uncommon occurrence is the partial destruction of the epiglottis. In some of the cases of this disease that have come under my observation, nearly the whole of this fibro-cartilage was eaten away, nothing but a thick, narrow, stump-like remnant being left to cover the glottis, as illustrated in the annexed cut (fig. 69), from a preparation in

my private collection. The cricoid cartilage rarely participates in the disease.

The ulcers are seldom numerous, unless they are follicular, when the affected surface may literally be studded with them; in general, we do not find more than one or two, which are then pretty large, both as it respects their depth and superficial area. They are of a circular or oval shape, with indurated edges and a foul bottom, and, in the more severe and protracted cases, they sometimes penetrate to a great depth, opening perhaps externally, as I have witnessed in several instances. Such an occurrence is most likely to happen when there is extensive destruction of the thyroid cartilage.

Occasionally the mucous membrane, instead of being ulcerated, is the seat of granulations, or syphilitic warts, of a red, fleshy appearance, and from the size of a small pin-head to that of a mustard-seed, their number varying from half a dozen to fifteen or twenty; they are usually most conspicuous around the vocal cords, and apparently consist in a hypertrophous condition of the mucous crypts which naturally exist in the interior of the vocal tube.

The symptoms of syphilitic disease of the larynx are generally well marked, particularly when it has made considerable progress, or when it presents itself in the form of ulceration. Besides the wan, emaciated, and cachectic appearance of the patient, which is itself almost sufficient to point out the nature of the affection, there is a hoarse, husky, characteristic state of the voice, which, in time, is reduced to a mere whisper, and eventually completely lost. The larynx feels tender on motion and pressure; deglutition is difficult and painful; and the slightest vocal exertion is productive of severe suffering. Cough is always present, frequently to a most harassing extent; and in attempting to swallow fluids the patient is frequently seized with symptoms of impending suffocation. The matter which is expectorated is excessively fetid, often bloody, and occasionally mixed with fragments of cartilage, its quantity being frequently very copious. As the disease progresses, the local and constitutional irritation increases; the emaciation becomes extreme; the sweats are copious; and the patient at length dies completely exhausted, the immediate cause of his death being, perhaps, inanition, suffocation, or hemorrhage from the sudden giving way of a considerable sized artery. Long before this event, however, the lungs, pleuræ, and bronchial tubes become seriously involved, and thus serve materially to hurry on the fatal crisis.

5. SYPHILIS OF THE EYE.

Iritis belongs to the more advanced stages of syphilis, being usually associated with tubercular, papular, or pustular eruptions, rupial sores, nodes, and rheumatism of the bones, and ulceration of the throat, palate, and nose. It is characterized by a fixed and contracted state of the pupil, which is generally filled with lymph and displaced upward and inward; by the appearance, upon the anterior surface of the iris, of reddish-brown tubercles, or minute yellowish abscesses; and by severe nocturnal pains, situated deep in the eye, forehead and temple.

The disease commonly attacks both organs, either simultaneously or successively, and always rapidly extends to the other structures, as the cornea, choroid, and retina, involving them in its ruinous consequences, few persons recovering without loss of sight. As allusion will again be made to this affection in the chapter on the eye, no further notice need here be taken of it.

In April, 1858, Dr. Addinell Hewson read before the Pathological Society of Philadelphia, the history of a case of supposed syphilitic *retinitis*, in a stout man, thirty-one years of age, who had contracted primary syphilis upwards of two years previously. He had subsequently labored under loss of flesh and strength, alopecia, and sores on the skin, lately followed by violent pain in the left temple, and dimness of vision in the left eye. There had been no iritis. Under the ophthalmoscope, the lens and vitreous humor appeared to be perfectly clear, but the retina was defective in translucency and of a dirty tint, its surface being extensively sprinkled with small white, yellowish-white, or reddish points, of a globular shape, and strongly resembling the condylomata of syphilitic iritis. The optic nerve was changed in color, and the vessels of the retina were somewhat varicose.

6. SYPHILIS OF THE SKIN.

Ulcers of the skin, or rupial sores, may be a sequence of secondary syphilis, but in general they are among the more remote effects of the tertiary form of the disease, coming on, in most cases, several years after the primary affection. They usually coexist with nodes and rheumatic pains, or with ulceration of the throat, nose, and larynx, or with all these ailments combined, and are nearly always preceded by scaly eruptions, pustules, papules, or tubercles. Persons of a broken, infirm, and cachectic constitution are their most common subjects, and those in whom they commit the greatest ravages.

Much diversity exists in regard to the situation and character of these cutaneous ulcers. They are most frequently found on the extremities, especially the inferior; they are also sufficiently common on the forearm and elbow, and on the scalp, forehead, and temple. Their size ranges from that of a split pea to that of the crown of a hat, their shape being usually circular or oval, although sometimes it is extremely irregular from two adjoining sores being connected or running into each other. The edges are nearly always callous, everted, and more or less ragged; the surface is excavated, covered with a greenish, pultaceous matter, and exquisitely sensitive; while the discharge, which is often very profuse, is thin, ichorous, and offensive, frequently excessively so. It is not often that we notice anything like a distinct, well-defined areola; such an occurrence is seen only in rare cases, but in most instances there is marked inflammation with redness and induration in the parts immediately around. The largest of these ulcers generally occur on the shoulder, side, and buttock, and it is truly amazing what an immense size they may sometimes attain. Numerous small ulcers of this kind occasionally exist in groups, giving the surface a peculiar worm-eaten appearance. In some cases, again, the ulcers

have a serpiginous arrangement; in another class of cases they are, perhaps, very much undermined; and now and then two large ulcers are connected together by a sort of cutaneous bridge. In fact, there is no end to the diversities of their configuration. Finally, they may be quite superficial, or so deep as to involve the subjacent cellular tissue, and even the fasciæ, muscles, tendons, and bones.

Rupial ulcers often continue for an indefinite period, sometimes partially cicatrizing, now spreading, now indolent or stationary. From local causes, as well as constitutional, they may take on almost any kind of action; when the patient is in an exhausted, irritable condition, they are very apt to become severely inflamed, and to assume a phagedenic, sloughing character, spreading often with immense rapidity, both in diameter and depth. The system generally actively sympathizes with these sores; the skin is dry and hot, the pulse small, quick, and frequent, the appetite impaired, the sleep destroyed, and the loss of flesh and strength excessive. The patient has an old, superannuated, care-worn look, with all the signs of a deep-laid syphilitic cachexia. The scars left by the healing of these ulcers are abnormally white, and retain for a long time a remarkable hardness, with a tendency to constant furfuraceous desquamation. They are sometimes very rough, and prone to reopen from the slightest causes.

The *diagnosis* of syphilitic ulcers is generally sufficiently easy, the only affection with which they are liable to be confounded being the common non-specific sore. There is generally an appearance about a specific ulcer of the skin which at once stamps its character. In the first place, it is generally circular or oval, and of an excavated shape, with hard, everted edges, and a foul surface, destitute of granulations and of healthy discharge; the surrounding surface is indurated, and generally somewhat discolored. Secondly, the sore is often multiple, occurring in groups, and also on different parts of the surface; a circumstance which is generally of itself sufficient to denote its nature; for the ordinary ulcer is usually solitary, and is most common on the lower extremity. Thirdly, the disease of the skin nearly always coexists with syphilitic disease in other structures, especially the periosteum and bones. Finally, the effects of the treatment afford important aid in doubtful cases; ordinary ulcers disappearing, or soon assuming a healthy, granulating appearance, under simple antiphlogistics, rest, and light diet, whereas specific ulcers always require the use of iodide of potassium and mercury, the latter often both internally and externally.

The syphilitic eruptions are sometimes attended with *onychia*, or inflammation of the matrix of the nails, the latter of which gradually become dry and black, and eventually drop off, leaving a foul, excavated, painful ulcer, with hard, steep edges, and a very fetid, ichorous discharge. If the morbid action be very severe, or if it be not soon arrested, the matrix will be completely destroyed, when there can of course be no reproduction of the nail; most commonly, however, a part of its substance survives, and afterwards makes a feeble effort at the formation of a new nail, which, in general, however, is merely an ill-shaped, stumpy, horn-like excrescence, altogether different from

the original structure. The diagnostic signs of the disease are the copper-colored appearance of the surface immediately around the ulcer, and marks of syphilis in other regions of the body. The lesion occasionally does not appear until many months after the primary sore, thus bringing it, properly speaking, under the head of tertiary symptoms.

7. SYPHILIS OF THE OSSEOUS SYSTEM.

Affections of the periosteum and bones belong to the later order of tertiary syphilis, and they may declare themselves in various forms, of which the most important are nodes, or soft tumors, inflammatory hypertrophy, exostosis, caries, and necrosis. These affections may come on at any time after the eighteenth month from the date of the primary sore, but in the great majority of cases they do not show themselves until after the lapse of at least twice that period. They are most liable to occur in persons of a scrofulous and cachectic constitution, and in those whose health has been destroyed by habitual intemperance, constant exposure, and deficient alimentation, leading to an impoverished state of the blood and protracted derangement of the secretions. The idea is now generally prevalent that diseases of the periosteum and bones, especially in their more severe forms, are, in great measure, limited to those persons who have undergone severe courses of mercury for their cure; and in this opinion the results of my experience induce me fully to concur. Of the many cases of tertiary syphilis of the osseous tissue that have fallen under my observation nearly all had taken mercury in large quantity, and the few who had been treated without that remedy had suffered comparatively little, except where there was a marked strumous diathesis, which never fails, I think, to aggravate the effects of the ingrafted disease. It would thus appear, at first sight, that this metal, by combining with the specific poison, was capable of essentially modifying its action, if not of forming a new virus, more potent and destructive than the original. But it is not necessary to have recourse to such an explanation; it is sufficient to know that the action of mercury, when carried to an inordinate extent, is a most powerful depressant, the effect of which is felt, for a long time, by the whole system, by the blood not less than by the solids. A species of physical degradation of the entire organism is thus engendered, which cannot fail to predispose it, in no slight degree, to the injurious operation of morbific agents, whether acting within the system, or impressing it from without, through the medium of the cutaneous and mucous surfaces. Instead, therefore, of supposing that a new poison, or a sort of a syphilitico-mercurial virus, is formed under these circumstances, it will be found to be more in accordance with the established facts of pathology to conclude that the frightful ravages so often committed in tertiary syphilis, after the inordinate use of mercury, upon the osseous tissue, are the result, exclusively, of the deteriorating influence of this metal upon the general system, whereby the more feebly organized structures, as the bones and their investing membrane, are rendered peculiarly prone to a bad form of inflamma-

tion, which, if not early checked, often leads to the most serious consequences.

Tertiary syphilis is met with only in certain bones, chiefly in the superficial, or in those least protected by soft parts, as the tibia and fibula, the ulna, clavicle, and bones of the skull, nose, palate, and upper jaw. In rare cases, almost every piece of the skeleton is involved, either simultaneously or successively; some in nodes, some in caries, some in necrosis, and some in exostosis.

Nodes occur chiefly upon the tibia, ulna, and skull, particularly the frontal and parietal bones. They present themselves as circumscribed, semi-solid swellings, of an ovoidal shape, somewhat elastic to the touch, and from half an inch to an inch and a half in diameter. So far as we are able to determine, they always begin beneath the periosteum, upon the surface of the bone, as an inflammation, which is soon followed by the deposition of a remarkably gummy substance, of a light, turbid, or greenish hue, and of the nature of caco-plastic lymph. In many cases this is the only substance found in the swelling; in others, however, it contains, in addition, a considerable quantity of serum or of pus, or the gummy matter may be entirely absent, and the tumor be occupied by an imperfectly elaborated pus. The periosteum and bone, at the seat of the node, are both inflamed, softened, and ulcerated; and as the tumor extends, the superincumbent structures, participating in the morbid action, become red and painful, and ultimately yield at the most prominent point, thus allowing the pent-up fluid an opportunity of escaping, although generally in a very imperfect manner, and not without severe suffering.

A node is essentially an abscess of the fibrous and osseous tissues, the consequence of a specific inflammation, and occupied by an imperfectly elaborated pus, or a mixture of pus and plasma. Its course is always chronic, and the pain which attends it is peculiar, being of an intermittent, neuralgic character, subject to violent nocturnal exacerbations. The general health is always disordered, and, if the swelling is large, considerable constitutional disturbance is apt to be present. In many cases, nodes co-exist in different pieces of the skeleton. The skull is sometimes studded with them.

A node may not only ulcerate, but also mortify; and after it has become an open sore, it may take on an almost endless variety of morbid action, incident to syphilis in other structures. Thus, it may be excessively irritable, be invaded by phagedena or gangrene, burrow extensively among the surrounding tissues, be complicated with serious disease of the osseous tissue, or, lastly, be indolent and indisposed to heal.

Caries of the bones is most commonly met with in the long bones of the extremities, as in the tibia and ulna, and in the palate, maxillary, nasal, turbinated, and ethmoid bones, together with the vomer; in all of which it is not unfrequently conjoined with *necrosis*, whole pieces dying and sloughing away, so as to cause the most frightful mutilation and disfigurement. These ravages are generally most conspicuous about the countenance, especially when the disease attacks and destroys the proper bones of the nose, which then caves in, and causes that

remarkable flattening of the face so characteristic of the effects of tertiary syphilis. In many cases the turbinated bones, the ethmoid, and vomer are separated, so as to convert the nasal fossæ into one immense cavity; and instances occur where, in consequence of the destruction of the palate and maxillary bones, the mouth and nose communicate with each other. In the long bones of the extremities, the caries and necrosis are generally superficial, the dead portions coming away in the form of exfoliations, the central parts of these pieces seldom participating in the morbid action to an extent sufficient to cause their destruction.

Syphilitic *hypertrophy* of the osseous tissue is extremely common, and sometimes involves the greater number of pieces of the skeleton; the bones, however, which are most liable to be attacked are the tibia, fibula, femur, ulna, radius, and cranium. The lesion occurs either as an exostosis, or as a diffused swelling, which, when it affects the whole length and thickness of a bone, assumes the name of general hypertrophy. The mode of formation of a syphilitic exostosis presents nothing peculiar, and need not, therefore, claim any special attention; it evidently takes its rise in a deposit of plasma, which serves as a nidus for the future growth, the ossific process passing through the same phases as in the natural skeleton. The tumor is usually knobby and irregular, with a broad base, and a rough scabrous surface. In cases of long standing, it is nearly always of a hard, ivory consistence.

The more common variety of hypertrophy is the diffused or general, of which the best specimens are usually seen in the bones of the leg, thigh and forearm, which are often nearly twice the natural thickness and of extraordinary weight and firmness. A section of such a piece (fig. 70), shows that the spongy substance has been completely, or

Fig. 70.

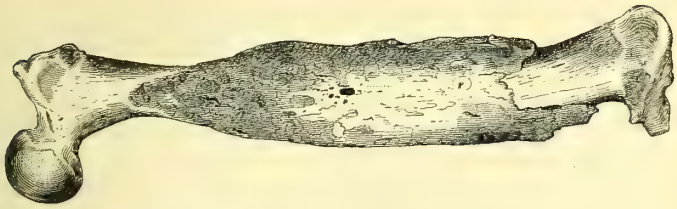


General hypertrophy of the femur; internal structure.

almost completely replaced by solid osseous matter, that the medullary canal has been obliterated, and that the compact structure has acquired a closeness of texture almost equal to that of ivory. The Haversian tubes are for the most part obliterated, or greatly changed in their size and shape, and the outer surface of the bone is remarkable for its roughness (fig. 71), its appearance bearing a striking resemblance to that of a worm-eaten tree. The skulls of persons laboring under tertiary syphilis are sometimes astonishingly hypertrophied. In a specimen, presented to me several years ago by Dr. Cochran, of Louisiana, the cranial bones are throughout at least half an inch in thickness; the different pieces are completely fused together without any trace of

suture or of diploe, and their consistence and density are almost equal to those of ivory.

Fig. 71.



General hypertrophy; external characters.

The *periosteum* is variously affected in syphilitic diseases of the bones; in the more inflammatory lesions it is generally very vascular, soft, and spongy, at the same time that it is considerably thickened, and easily detached from the subjacent surface. In hypertrophy, especially the diffused form, the principal alterations are thickening and induration, with a tendency, here and there, to ossification. Instead of being easily separated from the affected bone, as it is in the more acute affections, it always adheres to it with extraordinary firmness.

The various syphilitic affections of the bones, but especially diffused hypertrophy, are all attended with more or less disturbance of the general health, and deep seated, excruciating pains. These pains, from the fact that they are always worse at night, have earned for themselves the title of *nocturnal*, although they are rarely entirely absent even in the day; they are also frequently called syphilitic rheumatic pains. They are generally of a dull, heavy, aching, or gnawing character, and begin to increase in severity the moment the patient becomes warm in bed; they may continue all night, or go off in a few hours, but while they last the patient has neither sleep nor comfort of any kind. Not unfrequently they are of a neuralgic nature; excessively keen, darting, and coming on in nightly paroxysms. While they exist, the affected bones are generally exquisitely tender and intolerant of manipulation.

8. SYPHILITIC ORCHITIS.

Syphilis of the testicle must be classed among the tertiary symptoms, since it rarely comes on until a long time after the primary sore. The average period in the cases that have fallen under my notice, was from two to four years; but it not unfrequently happens that the enlargement does not show itself until after the lapse of eight, ten, or even twelve years. It is usually associated with syphilis in other parts of the body, particularly of the bones, joints, throat, nose, and skin, the latter of which is often extensively ulcerated and otherwise disordered. These complications, which are seldom entirely absent in any case of syphilitic orchitis, are especially liable to occur when the tertiary affection breaks out long after the primary one, and they are always denotive of an

infirm cachectic state of the system, induced by long suffering, neglect, or bad treatment, or all these causes combined.

The disease almost always involves both testicles, either simultaneously or successively, although seldom in an equal degree; and, as it proceeds, it is sure to extend to the epididymis, so that, in time, the two structures form one inseparable mass. The swelling is characterized by extraordinary weight and hardness, the affected organ resting upon the hand like a heavy solid body, and requiring constant support to prevent it from causing a sense of dragging. When the disease has reached its maximum, the testicle is often six or eight times the normal bulk. The surface of the swelling is variable, though in general it will be found to be rather smooth, or but slightly knobby. The induration is uniform, except when there is, as not unfrequently happens, an accumulation of water in the vaginal tunic, in which case the corresponding portion will be soft and fluctuating. The spermatic cord usually participates in the disease, being unnaturally hard and thickened. When the disease is of long standing, the affected structures lose their normal characters completely, either at particular points, or throughout, the seminiferous substance being replaced by fibrous tissue. In the worst forms of the malady tubercular deposits occur, which, breaking down and disintegrating, lead to the formation of unhealthy abscesses, and, when these discharge their contents, to the establishment of fungus.

Syphilitic sarcocele is always a very indolent disease, its progress being remarkably tardy and painless. It is only, as a general rule, when there is much water in the vaginal tunic, constituting the complication called hydrosarcocele, and causing constant pressure upon the inflamed and degenerating tissues, that the patient will be likely to complain of much pain, and then chiefly at night and in damp states of the atmosphere. When the swelling is very large, considerable inconvenience is usually experienced from the weight and bulk of the organ. The subjects of this form of syphilis are always thin, pale, and anemic, the appetite is greatly impaired, the strength is wasted, and the sleep is constantly interrupted by nocturnal rheumatism. Their whole appearance, in fact, is indicative of a worn-out, miserable state of the system. When both organs are extensively diseased, the individual must necessarily be impotent. A remarkable feature of this form of syphilis is its tendency to recur, perhaps again and again, after being apparently relieved by treatment.

Syphilitic orchitis can always be easily distinguished from common orchitis; first, by the tardy, indolent, and persistent character of the swelling; secondly, by the simultaneous, or successive involvement of both organs; thirdly, by the co-existence of syphilitic disease in other parts of the body, especially of nodes, and ulcers of the skin, nose, and throat; fourthly, by the gradual but certain destruction of the texture and functions of the testicle; and, lastly, by a careful consideration of the history of the case, particularly of the character of the patient. In obscure cases, before resorting to extirpation, the surgeon should make a faithful trial of anti-syphilitic remedies, otherwise he may have occasion to lament his rashness.

The subjoined case, which I treated at the Clinic of the Jefferson College, in the winter of 1857, affords an excellent idea of the nature, progress, and termination of syphilitic orchitis, with the changes experienced by the affected organ. It was drawn up by Dr. S. W. Gross.

A man, aged 29, had a fungus of the right testicle, which had commenced four months previously, as a small pustule on the scrotum. He had contracted chancre and bubo nine years before, and was laboring at the time of his admission under syphilitic rheumatism, ulceration of the tibia, and a slight eruption upon the face. The right testicle began to enlarge, and to become hard and painful three years ago. The left organ was also diseased, but in a less degree. The general health was much impaired. The fungus, above alluded to, was about the size of a half dollar, and the seat of an offensive, ichorous, and profuse discharge, as well as of severe pain, especially at night. Being satisfied, from a careful examination, that the organ was hopelessly destroyed, I had no hesitation to remove it. The dissection verified the correctness of my diagnosis. The tubular structure was completely annihilated, a fibrous substance, of a pale yellowish color and dense consistence, occupying its place. At the posterior part of the epididymis was an abscess, about the volume of a small hickory-nut, filled with a tough, yellowish, cheesy-looking matter, bearing a close resemblance to tubercular deposit. The wound soon healed, and under the use of iodide of potassium and bichloride of mercury, aided by a nutritious diet, the patient rapidly improved in health and spirits. A year previously to this, I performed a similar operation upon a middle-aged man, who had also labored for a long time under tertiary syphilis. The fungus was of large size, and the testicle was completely degenerated into fibrous tissue. Whenever syphilitic orchitis is of long standing, whether it is accompanied or not by fungus, it will generally be found that its tubular substance is irretrievably destroyed.

9. CONDYLOMATOUS GROWTHS.

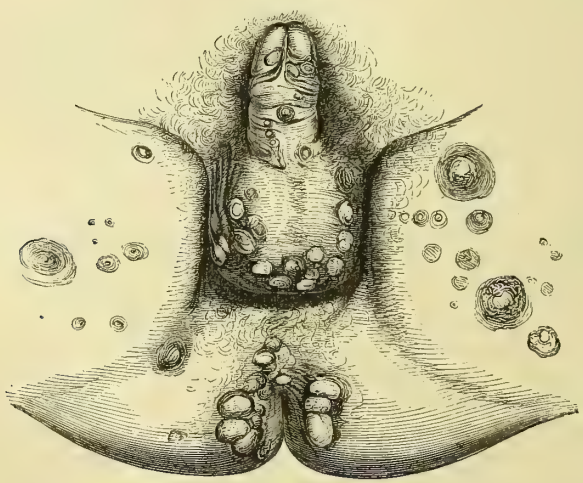
Condylomata of the skin, or of the skin and mucous membrane, usually described by the French syphilographers under the name of mucous tubercles, occasionally arise as a consequence of venereal contamination. They consist in the development of various sized excrescences, of a flat and rather broad appearance, occurring either in groups or in isolated tubercles, and dependent essentially upon a hypertrophied condition of the integuments. It is difficult to assign to this disease its precise rank in the order of syphilitic phenomena, or even to affirm, with certainty, that it is always plainly of a syphilitic character. There are not wanting surgeons of great eminence who do not hesitate to assert that these condylomata may be produced by the contact of gonorrhœal matter, or by acrid vaginal and other secretions not specific in any way. On the other hand, it has been alleged that they pertain, not to one form of syphilis, but to all three, now following chancre, now secondary syphilis, and now tertiary. As for myself, I am inclined to regard them as of a constitutional character, depending upon the absorption of the syphilitic virus, and displaying them-

selves at a period more or less remote from the primary sore; as belonging, in fact, rather to the third order of phenomena than to the second, and under no circumstances whatever to the first. The idea of the constitutional origin of these bodies is strongly corroborated by the acknowledged fact, that they always require a course of constitutional treatment for their permanent eradication.

These excrescences sometimes arise as a result of hereditary syphilis. Of this rare occurrence, however, I have seen only one example. The patient was a boy, eight years old, whose father himself had had a similar affection several years previously, in consequence of tertiary syphilis, attended with nodes and a scaly eruption. The tubercles existed in great numbers around the anus, and upon the lower part of the perineum, and could not possibly have been better characterized; the child was pale and somewhat emaciated, but there was no other evidence of constitutional contamination. The mother had given birth to three infected infants, two before, and the other at the full period; the former were cast off dead, and in a putrid condition, and the latter died at the age of three months from marasmus, the whole body having been covered with scaly eruptions, which were particularly conspicuous on the forehead, hands, and feet.

The most common sites of condylomata are the scrotum, vulva, perineum, anus, and buttocks (fig. 72). They also occur, though unfrequently, on the penis, and in the folds of the thigh, in the axilla, and

Fig. 72.



Condylomata.

in the ear. They seem to have a particular predilection for parts which are habitually hot and moist; for it is there that they are not only most frequently found, but that they acquire their greatest and most rapid development. Their size and shape are very various. Thus, they may not be larger than a pin-head, or a mustard-seed, but on the other hand, they often acquire the volume of a filbert, and even

of a small almond. In shape, they are usually flat with a broad base, though not unfrequently the free portion is much larger than the adherent, a circumstance which gives the growths a pediculated aspect. When they occur in groups, as is very apt to be the case, they often coalesce, forming thus considerable masses, tuberculated on the surface, irregular in shape, of a reddish color, and of a firm, fibrous consistence. The largest and worst of these tumors always occur at the margin of the anus, and on the perineum, vulva, and other parts which, from the contact of the opposing surfaces, are habitually subjected to friction, heat, and moisture, which, as already stated, are greatly conducive to their development. In these localities, the tumors are always humid, exhaling a thin, muco-purulent fluid, often quite abundant, and always excessively fetid. In those parts, on the contrary, where they are more exposed to the air, they are dry, insensible, of a darkish color, and partially incrusted with scabs.

Condylomata often co-exist with other evidences of a syphilitic taint, especially affections of the bones, rupial sores, tubercles, and scaly eruptions. Their course is variable; sometimes steadily onward, at other times stationary, and now and then even retrogressive. Exercise and friction always irritate them, causing them to become sore, and sometimes so exquisitely sensitive as to deprive the patient of the power of locomotion. When they are large and numerous, the discharge is generally copious and almost insupportably offensive. It is rare that they are accompanied by febrile symptoms.

It has been supposed that the discharge furnished by these excrescences is contagious, and, consequently, capable, by inoculation, of producing a similar disease. A great deal of plausible testimony has been adduced in favor of this opinion, by surgeons holding the highest position as observers and men of talent; but the notion has always appeared to me to be untenable, on the ground that these bodies, being always the result of a constitutional vice, are not capable of yielding any specific virus. When they co-exist with chancre, the occurrence of infection during sexual intercourse is easily explicable.

The diagnosis of condylomata cannot be mistaken. The situation of the excrescences, their peculiar shape, their chronic character, and their fetid secretion all serve to give them a distinctive character. Corroborative testimony is often furnished by the history of the case and the co-existence of syphilis in other parts of the body.

Treatment.—The treatment of tertiary syphilis reposes upon broad, scientific, and philosophical principles, and may therefore generally be pursued with a positive certainty of affording great relief, if not of ultimately effecting a radical cure. Even the worst cases may usually be immensely benefited in a very short time under the modern system of treatment; and I have repeatedly seen patients, apparently on the very verge of the grave, who had not enjoyed a comfortable night's sleep for years, and whose bodies had been sadly deformed and racked by pains, raised to health and usefulness by a few doses of medicine. The remedy to which we are indebted for these wonderful effects is the *iodide of potassium*, which, if there be such a medicine as a specific, is unquestionably entitled to that distinction. Experience has shown

that it is capable of performing for tertiary syphilis what quinine is for intermittent fever, or arsenic for neuralgia. It is the remedy *par excellence* in tertiary syphilis; a modern discovery of stupendous consequence to the human race; a remedy without which it would be impossible to treat this disease with any prospect whatever of success in almost any case, however simple. Let me not, however, in making these broad statements, be misunderstood. I do not wish to assert that iodide of potassium is absolutely infallible; like quinine and other great remedies, it occasionally disappoints expectation; but we may safely claim for it a degree of certainty which no other article of the materia medica possesses, as an antisyphilitic agent in the tertiary stage of this affection. I therefore ask for it, as has been done by many others, an undoubted confidence in its efficacy, and a fair trial of its use.

The exhibition of iodide of potassium may usually be commenced without any preliminary treatment; it is only when there is great disorder of the secretions that any preparation of the system will be necessary, and then it need not generally extend beyond a single dose of purgative medicine, and the administration of a full anodyne. The proper mode of exhibition is that of solution in distilled water, either alone, or with some bitter infusion or tincture, as hop, gentian, or quassia, such a combination being particularly desirable in the event of a gentle tonic being required. The dose of potassium has been a prolific source of dispute. Long experience has taught me that, while less than ten grains will rarely do much good, there are few cases in which more than this quantity is really ever needed. I have therefore found this to be a good average dose, repeated three times a day, at intervals of eight hours. When a rapid effect is required, as when there is unusual urgency of the symptoms, an additional dose may be given, but this will seldom be necessary. I have occasionally administered twenty, twenty-five, and even thirty grains at a dose thrice daily, but the effect, instead of being gratifying, has generally disappointed me, the medicine seeming to act as an irritant rather than as a calmative, as it always does when it agrees perfectly with the system. I have never given drachm doses of the article, as is done so often by others, and I should regard such practice as altogether unmeaning, if not positively prejudicial. We cannot take the disease by storm; the treatment must be chronic, in conformity with the malady which it is intended to cure; hence it requires patience, regularity, and perseverance rather than a display of strength and heroism. The remedy must not be abused. The practitioner should be intent upon accomplishing a certain amount of good every day, until he succeeds in eventually expelling the implacable foe effectually from the system. Conducted upon this plan, a most rapid and decided amendment generally occurs; the sleep, appetite, and strength daily improve; the countenance loses its wan, cachectic appearance; and in less than a fortnight, often indeed in less than a week, the patient looks and acts like a new being, his whole condition, physical and mental, evincing the astonishing change wrought by the medicine.

Iodide of potassium, especially when given in large doses, occasionally signally disagrees with the system, rendering it necessary either

to suspend its use altogether, or to administer it in a modified form, or in smaller quantity. The most common effect which it induces is an irritable condition of the air-passages, with a sense of fulness in the head and frontal sinuses, a thin watery discharge from the nose, more or less sneezing, vascular injection of the conjunctiva, and a general feeling of discomfort, the symptoms strongly resembling those of a rather severe coryza. This effect sometimes declares itself after the exhibition of only a few doses of the medicine; at other times it does not appear until after the lapse of eight or ten days, or until the system has been pretty well saturated with it. In some cases, depending evidently upon a strong idiosyncrasy, the smallest quantity almost is sufficient to produce excessive discomfort, and an invincible repugnance to the further use of the remedy. Among the more uncommon effects to which the iodide of potassium may give rise are, gastric irritation, diarrhœa, salivation, glossitis, vesicular eruptions of the skin, excessive diuresis, hemorrhagic discharges from the urethra and vagina, and cerebral excitement not unlike that occasioned by alcoholic drinks.

The best mode of counteracting these disagreeable effects of the medicine is to combine it with an anodyne, as a small quantity of morphia, or from five to ten drops of acetated tincture of opium with each dose. In some cases I have found the free use of strong hop tea to answer the purpose, while in others a mere diminution of the dose was sufficient. I do not remember an instance in which I have been compelled, on this account, to abandon the use of the article altogether.

The length of time during which the potassium should be continued must, of course, vary in different cases and under different circumstances, and does not therefore admit of any definite statement. In the great majority of cases it should be exhibited for many weeks and even for a number of months, with an occasional intermission of three or four days, in order to afford the system a short respite, which is always found eminently beneficial whenever a medicine has to be used chronically. An invariable rule with me is to continue the remedy for several weeks after all disease has apparently vanished; and afterwards to give it for eight or ten days at a time at intervals of a month, on the same principle that we administer quinine periodically and for a long time, for the radical cure of intermittent fever.

Although I have no hesitation in declaring that iodide of potassium alone will often cure tertiary syphilis, yet I am quite satisfied, from personal experience, that its efficacy and efficiency are generally remarkably augmented by the addition of a small quantity of *mercury*. Indeed, so thoroughly am I convinced of the decided superiority of this course that I have of late years almost invariably employed it, thus greatly abridging the treatment, and much more completely eradicating the disease. The plan is particularly beneficial when the affection is of long standing, when it has deeply penetrated the system, as shown by the existence of nodes, nocturnal pains, and ulcers upon the skin, and when the patient has been fruitlessly subjected to frequent courses of the iodide alone. An infirm, broken-down state of the system is no bar to the use of mercury in this mode of combination; on the contrary, it often affords the medicine an opportunity for its best display.

The form of mercury which I prefer, and to which I have become much wedded, is the bichloride, which is readily dissolved by the iodide, and may be given in doses varying from the eighth to the sixteenth of a grain three times a day. I usually begin with the twelfth of a grain, which is gradually increased, if necessary on account of the obstinacy of the case, to the eighth or sixth of a grain, which I rarely, if ever, exceed in any case. The effects of the remedy are of course carefully watched, the slightest tendency to ptyalism being a sign for its suspension, or, at all events, its more guarded use. In general, I have found it beneficial to continue the mineral until there is slight tenderness of the gums, with a metallic taste in the mouth, and to keep up this action afterwards for several weeks by repeating the dose occasionally as the effect begins to flag. In short, chronic mercurialization is wished for, not acute, which never fails to do harm; sometimes immense and irreparable. After the mercurial course has been sufficiently persisted in, the cure may be completed by the iodide of potassium, now given by itself, and perhaps in reduced doses, simply to maintain a slight constitutional impression.

When the bichloride disagrees, which, however, is seldom the case, a good substitute, although of inferior value, will be found in the blue mass, the gray powder, or the protoiodide. Donovan's solution, a compound of mercury, iodine, and arsenic, may sometimes be advantageously exhibited, the dose being from six to eight drops three times a day. It often proves serviceable in relieving rheumatic pains and swellings of the bones and periosteum. When the system is much dilapidated, the object is best attained by inunction, fumigation, or by the vapor bath, the remedy, when thus introduced, acting often much more beneficially and kindly than when administered by the mouth.

The topical application of mercury is particularly to be commended when the syphilitic disease is of unusually long standing; when the surface is covered with irritable, painful, and intractable sores; when there is deep involvement of the bones, as declared by the existence of nodes, diffused swellings, or caries and necrosis; or when the system is greatly exhausted by protracted suffering, want, and exposure, or long and injudicious courses of mercury by the mouth. Thus employed, its effects frequently display themselves in the most striking and efficient manner, in the rapid and extraordinary improvement that follows in the character of the several local affections and the condition of the general system.

The article which is usually employed for *inunction* is the simple mercurial ointment, from a drachm to a drachm and a half being rubbed upon the inside of the thighs and arms once a day until the constitutional effects of the medicine become apparent by the state of the gums, breath, and saliva. I usually add a small quantity of powdered camphor, with a view of rendering the ointment more soluble, and thereby facilitating its introduction into the skin. The friction should be very thorough, and be continued until the ointment has disappeared from the surface.

Mercurial *fumigations* may be conducted in a very simple manner, and with hardly any expense. All that is necessary is a large com-

fort, long enough to extend from the floor to the patient's neck, to which it is carefully secured with a piece of tape, so as to prevent the fumes from escaping into the room and entering the sufferer's lungs. For want of this precaution, suffocation has occasionally occurred, as in an instance which took place, many years ago, at the Louisville Hospital, in a man affected with tertiary syphilis. Or, instead of this, the body may be surrounded with a cloak of oil-cloth. The patient, completely stripped, is seated in a large arm chair, or upon a stool, beneath which is placed the fumigating apparatus, consisting of a common dinner plate, and a spirit lamp, arranged in such a manner as not to endanger the safety of the person. The mercurial preparation usually employed is the red sulphuret, of which from half a drachm to a drachm is put upon the plate prior to the ignition of the lamp. The operation, which should not be repeated oftener than once a day, lasts from ten to twenty minutes, at the end of which time the patient should retire to bed, and cover himself well up in order to maintain the perspiration usually so auspiciously begun during the fumigation. Great prostration, however, may follow this sweating process, and hence care should be taken not to carry it too far, or to renew it too frequently. The length of time during which the fumigation should be continued must depend upon circumstances; in general, it will not be short of two or three weeks.

Another mode of employing mercury topically is by a combination of fumigation with steam, constituting what Mr. Langston Parker, of Manchester, terms the *mercurial vapor-bath*. It is applied after the same method as ordinary fumigation, with this difference, that, while the cinnabar or sulphuret is volatilized by means of a spirit lamp, the steam of hot water is conveyed from a boiler under the patient's mantle as he sits in his chair.

I can testify from considerable experience to the beneficial effects of these two methods of mercurialization, having effected some very extraordinary cures with them after all other rational means of treatment had failed. I recollect, in particular, the case of a young gentleman of Arkansas, who was under my charge, in 1855, on account of tertiary syphilis of many years' standing, attended with an enormous amount of rupial action of the skin, one of the sores being fully as large as a dinner plate, and with an infirm, cachectic state of the system, who was promptly cured, comparatively speaking, by daily fumigations with sulphuret of mercury, conjoined with the frequent use of the tepid bath, a nutritious diet, and stimulants, after a great variety of other means had been fruitlessly employed. My impression is that this mode of treatment is not sufficiently appreciated by the profession of this country. It certainly deserves the highest encomiums. When there is much disorder of the secretions, derangement of the alimentary canal, or a feverish state of the system, a short course of preliminary treatment will generally be necessary before commencing the fumigation process, as this will greatly augment its efficacy. In all cases the object should be to bring the mercurial vapor as fully as possible in contact with the syphilitic sores.

Simple and medicated *baths* often prove serviceable in tertiary

syphilis, not only as means of cleanliness, but by the direct soothing and healing influence which they exert upon the part and system. They are particularly beneficial in rupial ulcers and in rheumatic pains of the bones and joints. The emollient bath, prepared by mixing a basinful of thick gruel, or twice that quantity of wheat bran, with a suitable quantity of tepid water, generally proves most grateful. The common salt-water bath, or a bath containing a small quantity of carbonate of potassa, or chloride of sodium, is an excellent detergent and stimulant in the foul ulcers of the skin and bones so common in the advanced stages of syphilis. Occasionally the water may be advantageously impregnated with bichloride of mercury, from three to ten grains of the salt being added to the gallon of fluid, and the immersion continued for at least twenty or thirty minutes. Much caution, however, is required, especially when the surface is considerably denuded, otherwise severe ptyalism may arise. Baths containing nitric, hydrochloric, or acetic acid, are sometimes used, though of late they have gone much out of vogue, chiefly, perhaps, because they are inconvenient, and liable, if proper care be not taken in their preparation, to cause severe pain.

Besides mercury and the other means above mentioned, there are certain remedies which, although usually considered as being merely auxiliary, are, nevertheless, of great consequence in a curative point of view in the treatment of syphilis. At the head of these may be placed a properly regulated diet, tonics, sudorifics, and anodynes, which deserve the greatest attention in every case of the disease.

It is impossible to insist too strongly upon a well regulated *diet* in the treatment of this affection, when it is recollected how much its progress and virulence are influenced by the exhausted and impoverished condition of the system which generally attends it in its more advanced stages. No medicine can possibly produce its full and legitimate effects under such circumstances, without the aid of good, wholesome, and easily digestible food, stimulating drinks, especially brandy and whiskey, and an abundance of fresh air. The blood must be enriched and the solids rebuilt before it will be possible to eradicate the specific virus from the system.

Tonics are nearly always indicated; and quinine with iron will usually be found to answer better than any other combination. The bitter extracts, as gentian and quassia, are generally of no account, except in so far as they may conduce to improve the appetite. Occasionally benefit accrues from the use of some of the acids, particularly the nitric and hydrochloric, either alone or conjointly, and diluted with a large quantity of water. Formerly, powerful anti-syphilitic properties were ascribed to these articles, but it is probable that all the good they do is solely dependent upon their tonic virtues, and not upon any agency they possess in neutralizing the syphilitic poison. When much emaciation exists with want of assimilative power, or a feeble digestion, there is no article which holds out greater promise of usefulness than cod-liver oil, given in doses suited to the state of the stomach and the general condition of the system.

Sudorifics have long held a high rank in the treatment of syphilitic

affections, under a supposition, at one time quite rife, that they aided in carrying off the venereal poison, thus ridding the system of its noxious influence. Without conceding to them such a virtue, which they certainly do not possess, there is no question as to their general usefulness in all states of the economy attended with obstructed perspiration, so often present in the advanced stages of syphilis, particularly when there is serious involvement of the skin. The object for which such medicines are usually prescribed may be readily obtained by the warm, hot, or steam bath, assisted by tepid drinks, and various kinds of diaphoretics, as Dover's powder, antimony and morphia, and similar articles. Some caution is necessary in the use of sudorifics, lest injurious debility be induced.

But of all the auxiliary remedies now described, the most important, in every respect, are *anodynes;* their employment is absolutely indispensable, and it is therefore impossible to assign to them too high a rank. They are even, up to a certain stage of the treatment, of more consequence than food and drink. The patient is not only not able to sleep, but his body is literally racked with pain and surcharged with irritability. To look for any substantial improvement, under such circumstances, from ordinary remedies, would be worse than idle: it would be absurd. The first thing to be done is to quiet the system and induce sleep; and to accomplish this, anodynes must be exhibited in large and sustained doses, a grain of morphia, or its equivalent of solid opium, laudanum, or black drop being given every eight or twelve hours, according to the effects of the article. The manner in which anodynes are borne, in the worst forms of tertiary syphilis, is often astonishing, and can only be explained by the irritable condition of the nervous system.

I have not made any reference to *sarsaparilla* in the enumeration of the above remedies, simply because I am not sure that its employment in my hands has ever been productive of any appreciable benefit. Whether this has arisen from bad luck, or from the use of an inferior article, it is not in my power to affirm; I may state, however, that I have employed it in every form and mode of combination in which it is used in this and other countries, and am therefore inclined to believe that it has been invested with virtues which do not belong to it, or which are due mainly, if not solely, to its associate ingredients.

Finally, persons laboring under tertiary syphilis should live in a pure, dry atmosphere, and be well protected against cold. When it is remembered how easily the disease is provoked by exposure to cold, and by living in damp, underground, and ill-ventilated apartments, the importance of attention to this injunction cannot fail to be fully appreciated. The body should be well covered with flannel, both summer and winter, and the patient should not be permitted to sit in the draught.

The above general treatment is applicable, to a greater or less extent, to all forms and cases of tertiary syphilis whatever; it is only necessary, therefore, in concluding this branch of the subject, to refer to the topical measures, and to such modifications of treatment as are

likely to grow out of the anatomical relations of the individual structures and organs liable to suffer from this disease.

There are certain rules of treatment which are applicable to all local affections, whatever be their site or extent. Thus, the surgeon does not hesitate to remove dead bone, to open abscesses, to trace out sinuses, divide fasciæ or aponeuroses, and trim off the ragged, undermined and impoverished edges of cutaneous ulcers, so as to place them in a more suitable condition for speedy reparation. All this is self-evident, and only requires mention to secure attention. Cleanliness is of paramount importance in all cases, as it contributes not merely to personal comfort, but also, in a powerful degree, to recovery. Fetor is allayed by the free use of the chlorides.

Ulcers, fissures, eruptions, papules, and tubercles of the *skin* often get well with very little topical treatment, simply under the use of iodide of potassium, or potassium and mercury, with attention to cleanliness and other hygienic observances. When much inflammation is present, with a foul appearance of the part and a tendency to spread, the dilute tincture of iodine will come in play, with emollient cataplasms, or the warm water-dressing, simple or medicated. Touching the sores lightly once a day, or every other day, with dilute acid nitrate of mercury or the solid nitrate of silver, generally astonishingly promotes the cure. Unguents are not always as bad as they have been represented to be in these cases. I have often employed them with excellent effect, especially the opiate cerate, the balsam of Peru ointment, and the ointment of the nitrate of mercury, mixed with six or eight times its bulk of simple cerate. The mercurial ointment, much diluted, and mixed with opium, often makes an excellent dressing in the indolent form of rupial ulcer.

Syphilitic *onychia* is, strictly speaking, a rupial ulcer, and should therefore be treated in the same manner as similar sores elsewhere. If abscesses form under the nail, they must be punctured; and if the nail die, it must be removed, or trimmed, if it overhang and compress the diseased parts injuriously.

The topical treatment of tertiary ulcers of the *throat*, mouth, and tongue is restricted principally to applications of the acid nitrate of mercury and solid nitrate of silver, made at first once a day, and subsequently every third, or fourth day, according to the condition and progress of the sore. Weak gargles, or washes of acetic acid, tannin and sulphate of copper, chlorinate of soda, or of the cyanuret of mercury, in the proportion of from ten to sixteen grains of the salt to a pint of some bland, mucilaginous fluids, as linseed tea or infusion of elm bark, may be employed three or four times a day in the intervals.

In the treatment of syphilis of the *nose*, our chief reliance is upon injections of weak lotions of iodide of iron, sulphate of copper and tannin, tincture of myrrh, and chlorinate of soda, particularly the latter, as it imparts not only a healthy stimulus to the affected surfaces, but effectually allays fetor, so distressing and disgusting in this class of nasal complaints. Mercurial preparations are, as a general rule, improper, being extremely prone to pass into the stomach, and thus occasion salivation; but for this they would often be most beneficial.

In using injections for the nose, a large syringe with a long, perforated nozzle is required, the object being to bring the fluid in contact with every portion of diseased structure. They should not be repeated more frequently than thrice a day, and especial care must be taken that they do not distress by their severity. In fact, an injection of the nose should never smart beyond a very few minutes, and then only in a very slight degree. If it pains longer, it is an evidence that it is too severe to be beneficial.

If the affected parts are within reach, regular and steady medication may be effected with lint smeared with some suitable ointment or wet with some slightly stimulating lotion. In all cases the nasal cavities should be frequently inspected with a view to the early detection and removal of dead bone.

In syphilis of the *larynx* direct medication may be attempted by means of the mop wet with a weak solution—from ten to twenty grains to the ounce—of nitrate of silver, introduced once every third or fourth day, the patient being at the moment partially under the influence of chloroform so as to render the parts more passive, and, consequently, more tolerant of the operation, which is otherwise very apt to prove a complete failure. When the disease is extensive or the case urgent, as when there is deep ulceration with excessive difficulty of deglutition and frequent spasm of the muscles, or œdema of the glottis, nothing short of laryngotomy will suffice, and should be had recourse to without delay. Direct medication may then be made with acid nitrate of mercury or with any other article that may seem expedient. If warty excrescences be present, they may be clipped off with the scissors, repullulation being prevented by escharotics or sorbefacients. Dead cartilage is removed in the usual way.

The great remedy for syphilitic *iritis* is mercury pushed in such a manner as to produce a most rapid and decidedly salivant effect. No time is to be lost; the treatment must be prompt and earnest, with a view to the one result, or the eye is lost. If the patient be young or plethoric, blood is freely taken from the arm or by leeches and cups from the temple. Opium is given to allay pain and prevent the mercury from running off by the bowels.

Affections of the *bones* and periosteum of the extremities are treated upon general antiphlogistic principles. The local pain and swelling are often immensely benefited by tincture of iodine, leeches, and blisters, although in very many instances they readily yield to the internal exhibition of iodide of potassium and mercury. A node should not, as a general rule, be opened so long as it is very small, and unproductive of serious annoyance; when the reverse, however, is the case, it should be freely incised, and so also if it be the seat of distinct fluctuation, denotive of the existence of matter. A good rule, under such circumstances, is to make the knife graze the bone, imperfect division of the parts being generally worse than useless. If the resulting ulcer be slow in healing, it should be well blistered, or dressed with mercurial ointment, or some stimulating and anodyne lotion. Necrosed bone must be removed as soon as it is sufficiently detached to admit of its easy separation; while carious bone must be scraped and other-

wise managed to put it in a condition capable of undergoing reparation. Diffused hypertrophy rarely requires any other than constitutional remedies. Exostosis, properly so called, is usually free from mechanical inconvenience; should it act obstructingly, the best remedy will be the saw or pliers.

Syphilitic *sarcocele* is treated, topically speaking, upon the same general principles as swelling of the testicle from gonorrhœa, by rest of body and elevation of part, leeches, astringent and anodyne fomentations, and mild mercurial inunctions. When the enlargement is indolent and rebellious, strapping may be employed, either with common adhesive plaster, mercurial and ammoniac plaster, or the plaster of Vigo. The cure is often retarded in these cases by the presence of a considerable quantity of serum in the vaginal tunic, compressing and irritating the diseased organ. The proper remedy is a free incision, or repeated punctures. If abscesses and fungus form, they should be treated in the ordinary manner.

When the testicle is fungous, ulcerated, and completely disorganized, the only resource is removal, no treatment, either general or local, proving of any service in such a case. But, before so serious an operation is ventured upon, it should always be understood that the organ is really past recovery, and not merely apparently so.

The treatment of *condylomatous* growths must be conducted upon general and local principles. It is true, topical means alone will often cure them without difficulty; but to effect permanent riddance constitutional treatment is generally indispensable. The most efficacious remedy, for this purpose, is the iodide of potassium in union with the bichloride of mercury, administered as in tertiary syphilis, the diet, bowels, and secretions being at the same time suitably regulated. The specific treatment should be persisted in, in a modified manner, for several weeks after all disease has apparently disappeared, the object being to break up all tendency to recurrence.

In regard to the topical treatment, cleanliness is a matter of primary importance, hardly less on account of the attendants than of the patient himself. Free use must be made of tepid water, impregnated with the liquid chlorinate of soda, and applied by means of a sponge or syringe; if there be much discharge, the dressings and the bedclothes should be frequently sprinkled with the solution. Another important element of treatment is perfect rest with isolation of the affected parts, their contact having, as stated previously, a tendency to foster growth and secretion. To repress the tumors, various remedies may be used. The one usually recommended is the nitrate of silver, applied freely, in solid form, once a day. In my own practice, however, I have always preferred acid nitrate of mercury, or nitric acid, having found them much more effectual, and not any more painful. In the intervals of the applications the excrescences should be kept well covered with some desiccating substance, such as three parts of prepared chalk to one of carbonate of zinc, calomel, or dry lint. Under this management rapid improvement soon follows; the tubercles becoming dry, shrivelled, and less sensitive. In the minor cases, prompt relief generally follows the application, several times a day, of pulverized savin, with

a small quantity of tannin and a minute portion of sulphate of copper, or equal parts of powdered savin and alum. Great attention should be bestowed upon cleanliness for a long time after the excrescences have disappeared.

SYPHILIS IN THE INFANT.

Infants are subject to syphilis, and there are two modes in which they may become infected. First, they may suffer from direct inoculation, and, secondly, the disease may be communicated by either parent; by the father in the act of copulation, or by the mother during the process of pregnancy. It has also been supposed that a child may be contaminated by the milk of an unsound nurse, but if this be true, the facts have not been presented in such a light as to induce general conviction of their accuracy.

Direct, primary syphilis may be contracted, as, indeed, it most generally is, by a child in its passage through the soft parts of the mother, by the surface of the body coming in immediate contact with a chancre in the vagina, or on the vulva, or, at all events, with the secretions of such a sore. In this manner an eye may become inoculated, or the mouth, or, in short, any mucous surface that may entangle and retain the specific virus sufficiently long to admit of its absorption; for in so young a subject as this it is probably not necessary that there should be any actual solution of continuity in order to produce the effect, the mucous tissues being so delicate, and the lymphatics so active as to enable the poison to enter these vessels by direct imbibition. When the disease attacks the skin, however, it is generally, if not always, the result of direct inoculation from the matter being brought into contact with an abrasion on its surface. A nurse having a chancre upon her nipple may impart the virus to the infant's lips in the act of suckling, but such an occurrence, although possible, must be extremely uncommon.

In whatever manner the infection is caught, the resulting disease pursues the same course as when it occurs in the adult, whether from sexual intercourse or artificial inoculation. The child may perish from the local irritation, or, if it should survive the primary affection, it may afterwards suffer from constitutional syphilis, the impression manifesting itself in cutaneous eruptions, in mucous tubercles, sore throat, ulceration of the nose, and rheumatic pains in the bones and joints.

In the great majority of cases of infantile syphilis, however, the disease is communicated either through the seminal fluid of the father, in the act of procreation, or by the mother through her blood after the ovum has taken up its residence in the uterus. That the contamination may occur in both these ways has been incontestably proved by numerous observations, conducted with such care as not to admit of any reasonable doubt. The semen is a living fluid, and in a man laboring under constitutional syphilis the probability is that every spermatozoon is completely impregnated with the specific poison; hence it is only necessary that it should be mixed with the material

furnished by the mother in order to produce thorough vitiation of the new being. Thus, the very fountain of life is poisoned in the very act of conception, and it is therefore not surprising that all its sources should participate in the evil thus inflicted.

The time at which a female with secondary symptoms may communicate the poison to her offspring cannot be accurately stated. The probability is that it is very short. This is proved by the circumstance that such a woman frequently aborts within a few months after conception, evidently in consequence of the deleterious effects of the virus upon the fœtus. I suppose that the contamination is coeval with conception, occurring at the moment of the commingling of the two seminal fluids; for if it be assumed, as we have a right to do from the facts of the case, that the male can communicate the poison in this manner, why should a similar faculty not be ascribed to the female? She, too, furnishes an impregnable substance—a seminal liquor—which can no more escape contamination when her system is affected with secondary syphilis than the seminal fluid of the male. In both cases, the blood, the source of life, growth, and nutrition, is completely empoisoned, and hence all its products, whether solid or fluid, must necessarily participate in the evil effects to which such a state must give rise. But in the female these effects must be still greater than in the male; the whole function of the male, in the process of reproduction, consists in the deposition of a certain amount of semen, perhaps a solitary spermatozoon, while the female is also obliged not only to furnish a fluid, but after conception has occurred, she is compelled to nourish the new being, the most intimate connection being established between them by means of the placenta.

It has been alleged that a healthy child, or a child born of healthy parents, may be infected by a nurse affected with secondary syphilis; the milk being tainted, and capable of communicating the disease. Of the possibility of such an occurrence I entertain, I confess, great doubt; my own practice has certainly not afforded me any examples of it, while it has fallen to my lot to see several cases where the converse was the fact, healthy children having suckled infected women, and yet they remained perfectly sound.

It has been a contested point whether a child, laboring under constitutional syphilis, can infect its nurse by communicating the disease through the nipple, and the question, as might have been expected, has been answered differently by different writers. Those who have espoused the affirmative side of the question, rest their assertion upon the result of personal observation, the most reliable testimony of all, one would suppose, in a controversy of this kind; but it is not to be forgotten that observation is fallacious, and that all men, however competent to practise medicine and surgery, are liable to be deceived by their patients, especially in relation to venereal affections. Not only do the abettors of this doctrine assert the possibility of this mode of transmission, but they go further and allege that a nurse so affected has, in turn, infected her own offspring. In a case related by Mr. Hunter, and upon which great stress is usually laid by authors, it is stated that the diseased infant, in this way, successively inoculated three

wet-nurses, two of whom afterwards conceived, and were delivered of syphilitic children. Now, instead of looking upon this case in this peculiar light, I should be inclined to infer one of two things, either that this diseased child had had a chancre upon its lip, or, what is more probable, that the three nurses had all been previously infected.

Those, on the other hand, who contend that such a mode of contamination is impracticable, base their conclusions upon the fact that the matter of secondary syphilis is destitute of inoculable properties, no well authenticated case, or one entirely free from objection, having yet been observed of the transmission of the disease through its intervention. Now, if this be true, as undoubtedly it is of the adult, it ought to be equally true of the infant; and hence, although the child should have a specific sore upon the lip or tongue, and the mother a fissure, crack, or ulcer upon the nipple, yet, inasmuch as the secretion of the former is innocuous, no constitutional contamination can be caused by its contact with the exposed surface of the latter.

There is another question which closely connects itself with the preceding, and it is this: Is there any evidence, of a positive kind, that a husband laboring under secondary syphilis may communicate the disease to his wife through the agency of the semen? So far as I am aware, there is none, and yet the affirmative side of the question has met with some very warm advocates. It is absurd to believe that this fluid, when injected into the vagina and uterus, is ever absorbed, even supposing that it were retained for a considerable length of time, which, however, it rarely, if ever, is. There is certainly no satisfactory proof of such an event, and we must, therefore, at least for the present, reject it. It is different when impregnation occurs. Here, as already seen, the semen mixes directly with the corresponding fluid of the female, to which it at once imparts its deleterious properties, thereby effectually tainting the new being in the very act of its creation.

Hereditary syphilis is generally a grave disease; for, unless it be judiciously treated, it nearly always proves fatal. A great majority of the neglected cases terminate in abortion, the fœtus often perishing as early as the end of the third month, and from thence on death may occur at any period up to the full term of gestation, the child being usually thrown off in a putrid and horribly offensive condition. The number of successive abortions is sometimes remarkable; in one instance, communicated to me by one of my own patients, it amounted to thirteen, the woman never having brought forth a healthy infant. Cases of three and four successive abortions have repeatedly come under my observation. Now and then a woman will abort several times in succession, and then be delivered of an apparently healthy child; I say apparently healthy, for, although the new being may be perfectly plump and fat, and exhibit all the outward signs of the most perfect integrity, yet generally, in a very few weeks, it is found to present unmistakable marks of decay and disease. The first thing that is usually noticed is that it loses flesh and strength; becoming gradually thin and puling, and looking as if it had been withered by the sudden drying up of its juices. The skin has a dingy, muddy, shrivelled appearance, and hangs about in loose, soft folds. The

countenance is shrunken, wan, and ghastly, and resembles that of a man of seventy-five or eighty, instead of that of an infant a few weeks old. The voice is husky; the respiration is snuffling; the throat is sore; the gums are red and spongy; the lips and anus are fissured; and the body is covered with copper-colored eruptions, usually of the scaly kind, and intermixed with tubercles. Purulent ophthalmia is not uncommon, the inflammation usually coming on within two or three days after birth, and generally ending in total blindness. In some cases numerous superficial ulcers are found upon the surface, attended with a thick, tenacious discharge, and a hard, reddish, characteristic base. The hair often drops off in large quantity, both on the scalp and on the rest of the body. The well developed node and orchitis are of rare occurrence in infantile syphilis. Death, under such circumstances, is seldom protracted beyond the first three or four weeks after birth. Occasionally, the child may reach the end of the second or third year, and in a few instances life is prolonged until after the period of puberty, the individual having a stunted, sickly growth, and being the subject of deep ulcerations of the throat, palate, nose, and skin, with, perhaps, caries of the bones of the extremities, and stiffness of some of the principal joints. Such, in a few words, is an account of the most common effects of this direful form of this disease. Few children recover, and those who do are doomed to drag out a miserable existence, generally amidst the most loathsome and disgusting deformities.

Infantile syphilitic eruptions are liable to be mistaken for some of the more common affections of the skin incident to early childhood, and the *diagnosis* is not unfrequently environed with no little difficulty in consequence. In obscure cases, our chief reliance is to be placed upon the history of the attack, and other concomitant circumstances. From three to four weeks after birth is the average period of the appearance of the cutaneous affections, the sole of the foot, the buttock, scrotum, face, chest, and inside of the thigh and arm being the parts originally involved. The surface immediately around the eruptions is of a coppery or reddish-brown color, a condition very different from what is observed in ordinary diseases, especially eczema, lichen, prurigo, and lepra, with which they are most liable to be confounded. Besides this, which is always a most important symptom, diagnostically considered, the general appearance of the infant shows that it has received a severe shock; it is thin and emaciated, and progressively fails to an extent, and in a manner altogether unusual in common cutaneous maladies. The old, withered and shrivelled look of the child is almost, of itself, characteristic of the disease; the snuffling is another important element in the discrimination of the case, and too much stress cannot be laid upon the mottled, dingy, or muddy state of the skin. The history of the case will usually show that the parents have been the subjects of syphilis, or that they are actually suffering under it at the time.

Treatment.—The treatment of infantile syphilis must be prophylactic and curative. If the mother be suspected to be laboring under a constitutional taint, as she justly may be if she has had several consecutive abortions or miscarriages, or if she is in infirm health, with eruptions upon the skin, a plentiful discharge from the vagina, and an

ulcerated condition of the neck of the uterus, she should be promptly put upon a course of mercury and a properly regulated diet, in order to prevent the ill effects of the contaminated state of her blood upon the fœtus, and thus enable the latter to attain its full growth, and the full period of gestation. The mercurial course should be chronic, not acute, and as gentle as possible, lest it should excite abortion; and in most cases it will be beneficial to associate the metal with the iodide of potassium and some preparation of iron, with a view to a tonic effect upon the general system, which, as already stated, is usually in an impaired and cachectic condition, and therefore requires great attention to bring it up to its normal level. The diet should be mild and nutritious, the clothing should be warm, and the patient should have the full benefit of fresh air.

As soon as the child is born it should be taken from its infected mother, and confided to a sound wet-nurse, as an appropriate diet is absolutely essential to its preservation. If no suitable wet-nurse can be obtained, it should have an abundant supply of fresh cow's milk, or, what is better, of the milk of the ass, which approaches nearer to the human milk, in some of its more important properties, than that of any other animal. The body and limbs should be well protected with flannel, and frequent recourse should be had to the tepid bath, impregnated with bran, or mucilage, especially if there be eruptions, fissures, or ulcers upon the skin. An abundant supply of pure air will be indispensable. The fact is, too much attention cannot be paid, in every case, to the observance of the rules of hygiene.

The most important internal remedy is mercury, and it is here that this article often displays its effects to the greatest advantage in neutralizing the specific virus. If any one should entertain any doubt respecting the efficacy of this medicine, as an antisyphilitic agent, his scepticism will soon vanish if he will carefully watch the progress of the treatment and the good results that will follow it. If it is not positively a specific, it must be conceded that it approaches as near to it in this disease as anything well can, quinine in intermittent fever hardly excepted. The form in which I usually employ it is the bichloride, in doses varying from the fortieth to the fiftieth of a grain three times in the twenty-four hours, dissolved in distilled water, or, when there is need of a tonic, in a few drops of Huxham's tincture of bark. This should be steadily continued, with now and then a few days' interruption, for a number of weeks, not only until all disease is apparently gone, but for a considerable period after; and it will be well for the sake of the more complete eradication of the poison, to recur to the remedy occasionally until the child is several years of age. When the disease proves obstinate, the bichloride may generally be advantageously conjoined with the iodide of potassium, from the fourth to the eighth of a grain being given with each dose of the salt, according to the age of the child. When the body is covered with sores, pustules, or tubercles, a gentle course of mercurial fumigation will be advisable, but great care must be taken not to carry it to such an extent as to induce debility or to suffocate the child. Mild dressings may be used in the intervals, and of these the best will be very weak prepara-

tions of oxide of zinc or of the nitrate of mercury, in the form of unguent.

Cases sometimes occur where the bichloride of mercury does either no apparent good, or where it proves positively prejudicial; under such circumstances trial may be made of mercury with chalk, or, what is preferable, because not liable to cause gastro-intestinal irritation, of inunction with mercurial ointment, from half a drachm to a drachm being rubbed upon the inside of the thigh once a day, the surface being kept constantly covered with a piece of flannel.

SYPHILIZATION.

Within the last few years, attention has been directed, in various quarters, to the subject of *syphilization*, or the cure of syphilis by inoculation, with the virus of chancre. As early as 1844, Dr. Turenne, in attempting to transfer syphilis from man to the monkey, was struck with the fact that, when the inoculation was repeated a number of times, the tissues to which the matter was applied were at length rendered completely insusceptible to its influence. To the condition thus obtained, he applied the term syphilization. Supposing that the treatment might be advantageously applied to the human system, he accordingly instituted some experiments upon men, but the results of his observations were not given to the profession until after the publication of the memoir of Dr. Sperino, of Turin, in 1851. In this memoir numerous experiments are detailed, going to show that constitutional syphilis may be successfully cured by repeated inoculation. More recently the subject has engaged the attention of other observers, especially of Dr. Boeck, of Norway, the results of whose labors have been widely disseminated through the medical press of Europe and America. I am not aware that any experiments upon syphilization have been performed in this country.

According to Dr. Boeck, syphilization is justifiable at all periods of life, but it should only be resorted to after the development of secondary symptoms; for, as long as the disease is in its primary stage, inoculation would be improper, as no one can positively determine beforehand whether the constitution will become tainted or not. The earlier the treatment is commenced, the better, and the effect will always be the more prompt and decisive, when the patient has not been subjected to any previous mercurial course, which always renders the system more stubborn to its influence, and more prone to relapses.

The inoculation is performed with the virus of chancre, and it is immaterial whether the matter be taken from the indurated or the non-indurated sore. The parts selected for the operation are the trunk and the inside of the thighs and arms. In a few days pustules will form, the matter of which must be inserted into the skin, until no further effects result, when the virus of the primary sore must again be employed, and the same course be pursued as before, until it is found

that no further impression can be made upon the system. It will sometimes require the use of new virus five or six times, before complete constitutional immunity can be secured. The symptoms, as a general rule, begin to abate in from four to six weeks, but it may take a whole year before the disease is perfectly eradicated. It will be found, upon every repetition of the inoculation, that the pustules and ulcers become less and less, and, also, that they gradually lose their specific appearance and character.

In regard to the value of this treatment, it is obviously impossible, at present, to form any definitive conclusions; further observation alone can enable us to do this. The practice is, to say the least, exceedingly filthy and disgusting; a circumstance which, added to the tediousness of the cure, will probably serve as an effectual bar to its general adoption.

CHAPTER XII.

GENERAL DIAGNOSIS.

Diagnosis is the art of distinguishing and identifying diseases and accidents, or, in other words, of determining their seat, nature, and effects. Its study is of paramount importance to every practitioner, and he should therefore omit no opportunity of improving his knowledge of it. Its value, practically considered, has been felicitously expressed by Louis, the illustrious secretary of the French Academy of Surgery. "The science of diagnosis," says he, "holds the highest rank among the different branches of the healing art, as it is at once the most useful and the most difficult. The discernment of the peculiar character of each kind of disease and of its different species constitutes the source of all curative indications. Without a clear and exact diagnosis, theory must always be at fault, and practice frequently uncertain." It is by his knowledge of diagnosis that the practitioner acquires a command over disease which he who is destitute of it can never attain. It should therefore form the great object of his inquiry in every case of disease and accident; for to be able to locate and define their seat and character is almost to be able to cure them. To be incapable of doing this is literally to grope about in the dark; or to be tossed to and fro, like a mariner without a helm, upon an ocean of uncertainty. To disentangle truth from error; to give to disease "a local habitation and a name;" to distinguish one injury from another; and to base upon the knowledge thus derived a proper course of treatment, calculated to restore the sufferer to comfort and health; are among the highest attributes of the practitioner, and require an amount of talent, tact, and experience such as few men possess.

The very first thing that a surgeon does when he is called to a case of disease is to set up an inquiry into its true nature; to ascertain where it is situated, or what structures it involves; how it has been brought about; what progress it has made; and what are its essential characteristics, or in what particulars it differs from other lesions. In order to do this with any tolerable degree of success, it is necessary, in many cases, literally, to interrogate every important organ and tissue of the body, with a view of ascertaining which of them are more directly implicated in the disorder, which are free from suffering, and which are affected only sympathetically. Such a step is generally indispensable when the lesion is of spontaneous origin, or when it arises without any appreciable cause. When the converse is the case, a less elaborate examination will usually suffice to supply the requisite

light. Not unfrequently the nature of the complaint is perceived at a glance.

SECT. I.—EXAMINATION OF THE PATIENT.

To examine a patient well, so as to elicit all the light that may be necessary to a thorough comprehension of the nature of his malady, requires generally great tact and an extensive knowledge of morbid and healthy anatomy, physiology, pathology, and animal chemistry, not to say anything of microscopy, now so much employed as a means of diagnosis. Any one may make a superficial investigation, and in the more ordinary cases such a mode of procedure may perhaps be all that is required; but under opposite circumstances, where everything is shrouded in obscurity, nothing short of the most patient and elaborate exploration will usually answer the purpose. Knowledge and tact alone, however, will not insure success; they may go very far, it is true, in enabling the practitioner to solve the mysteries of a case, but unless they are aided by a nice faculty of observation, and by a just sense of discrimination, he will never be able to analyze and group the facts presented to him in such a manner as to render them fully available when he comes to apply his therapeutic agents. Unfortunately, however, the power of observation is a rare gift, which few possess, and still fewer use to advantage. Surgeons, like physicians, have eyes, but they do not always see, and ears, but they do not always hear. Another fault, of which, unfortunately, too many, even among the most sagacious and best informed, are frequently guilty, is the hasty manner in which examinations are made, and, hence, no wonder that so many disgraceful and fatal blunders are daily committed by men who, if they would only give themselves proper time, might see disease as clearly as if they were looking at it in a mirror. Hasty examinations commonly lead to hasty deductions, and hasty deductions to hasty generalization and slovenly practice. All practitioners do not of course require the same amount of time to arrive at a correct judgment respecting the diagnosis of their cases; some literally jump at conclusions; others reach them only by a slow and tedious process of examination and induction. Of the two, the latter are generally the safest practitioners.

The object of an examination is often seriously interfered with, if not entirely frustrated, by the want of co-operation of the patient, in consequence of his timidity, his want of intelligence, or the perverseness of his disposition. Much adroitness is therefore often required to bring out the desired result; fully as much as the lawyer is obliged to expend in the examination of a witness who is incapable of appreciating the responsibility of his position, or of making a proper use of his knowledge. To gain the confidence of a patient is one of the first duties of a practitioner, as this is often necessary not only to a full development of the history of his case, but to its successful management. A gentle word, an agreeable tone, a winning manner, are well calculated to effect this result, and are attributes of

the highest value, the more so as but few persons in our profession possess them.

Age, occupation, climate, and habits of life, being so many circumstances calculated to modify morbid action, should be among the first objects of inquiry at the bedside of the sick. There are many diseases which occur only at particular periods of life. Thus, scrofula is most common in children, scirrhus in elderly persons, chronic enlargement of the prostate in advanced age. The influence of occupation in the production of disease is well shown in hemorrhoids, varix, and ulcers of the legs, and, to go no farther, in necrosis of the lower jaw in persons engaged in the manufacture of lucifer matches. Gout, rheumatism, pneumonia, and pleurisy are most common in northern latitudes, while dysentery, hepatitis, and fever are most frequent in southern. Individuals of dissipated habits are particularly prone to erysipelas, boils, and carbuncles, and are often attacked with delirium tremens, when they become the subjects of severe injuries, as lacerated wounds, fractures, and dislocations.

Particular inquiry should be made into the previous history of the case; whether there is any hereditary predisposition to disease; whether the suffering organ was ever similarly affected before; how the present attack came on, how long it has been in progress, and what have been its chief symptoms. A careful examination of this kind cannot fail to elicit important and valuable information, which, if properly applied, may go far in saving the patient's life, or in cutting short his disease.

A knowledge of the *causes* of a disease often throws valuable light upon their diagnosis. Thus, the knowledge that a youth affected with urethritis recently had connection with a lewd female, at once leads to a proper comprehension of the nature of the case; and in the same manner important aid may be obtained in deciding between a specific and a non-specific ulcer on the head of the penis. The diagnosis of a malignant pustule upon the hand is generally determined at a glance by a surgeon of experience; but one of an opposite character will hardly arrive at such a result without being told that the patient a few days previously was engaged in flaying a cow, or in handling green hides. During the existence of endemic and epidemic diseases, all persons brought within their influence are liable to their attacks, and the similarity of the symptoms is consequently sufficient to stamp their character. The knowledge that pyemia frequently follows upon severe injuries and capital operations is of the greatest value to the practitioner, as it enables him at once to interpret correctly the symptoms which attend that peculiar affection, the nature of which was so long a mystery.

In accidents, a knowledge of the manner of their occurrence is often a matter of great moment in a diagnostic point of view. Thus, if a man, in the act of falling from a considerable height, has alighted upon the vertex, and is immediately rendered insensible, and particularly if he remains in that condition for a long time, the inference is strong that the base of the skull is fractured, and that he will perish from the effects of the lesion, although there may be no apparent injury

upon the portion of the head which received the blow. In railroad accidents the leg may be severely hurt, and yet not sufficiently so to account for the extraordinary depression of the system; inquiry discloses the fact that the body was violently compressed between the car and a post, and a more thorough exploration leads to the discovery of rupture of the spleen, liver, bowel, or bladder; a circumstance which at once establishes the diagnosis, and prevents the patient from being subjected to useless amputation.

When the patient is unconscious, whether from disease or accident, valuable information respecting the nature of the affection may often be obtained from his nurses and friends; or, in the latter case, from the by-standers, who thus become important witnesses of what transpired at the moment in regard to the manner in which the injury was inflicted, the previous state of the intellect, and the condition of the person immediately consequent upon the receipt of the lesion.

In the more obscure cases of diseases and accidents, the diagnosis can be arrived at only after the most patient, thorough, and systematic examination; a random exploration will be worse than useless. Every organ must be questioned, and even then it is often extremely difficult to determine what the lesion really is. In my own examinations I usually begin with the alimentary canal, from which I pass on, successively, to the abdominal and pelvic viscera, the lungs and their envelops, the heart, brain, and spinal cord, and, finally, the external surface, carefully noting everything of importance as I proceed. In this manner, it is difficult for any serious disease to escape detection, if the practitioner is at all endowed with the faculty of correct observation.

EXAMINATION OF THE DIFFERENT ORGANS.

In general, very useful diagnostic information is afforded by the state of the *tongue* in surgical affections. In traumatic fever, abscesses, rheumatism, and gout, the organ is usually unnaturally dry, and covered with a thick, white fur, at the same time that its tip and edges are abnormally red. A narrow, pointed, or acuminated appearance of the tongue is also frequently observed under these circumstances, especially in young subjects. In profuse hemorrhages the tongue is generally very pallid, soft, flabby, and indented at the edges. A dry, brownish, and tremulous state of this organ with difficulty of protrusion, is generally denotive of the existence of a typhoid condition of the system, and, in connection with other symptoms of exhaustion, is to be regarded as an unfavorable occurrence. It is the kind of tongue which commonly attends gangrene, malignant erysipelas, and the latter stages of traumatic fever.

The appearances of the tongue sometimes afford useful hints respecting the state of the digestive apparatus, and even of the general system. Thus aphthæ upon this organ, or small ulcers scattered over its surface, are usually denotive of chronic gastric disorder, or derangement of the stomach and liver, by correcting which the disease promptly vanishes. In constitutional syphilis, the existence of mucous

tubercles upon the tongue affords at once a satisfactory solution of the nature of the complaint. The presence of an excavated ulcer upon this organ, or upon the tonsils, with a copper-colored border and a foul bottom, is generally equally diagnostic of a contaminated state of the system.

A thick and tumid upper *lip* is generally denotive of a scrofulous taint of the system, or of a vitiated state of the alimentary canal depending upon the presence of worms, and disorder of the hepatic and follicular secretions. A cracked, chapped, or fissured state of the lower lip is often an accompaniment of general plethora, over feeding, and gastro-enteric derangement. A pale prolabium is indicative of a deficiency of the coloring matter of the blood, and is an evidence, in a general way, of the necessity of tonics.

Useful information is sometimes derived from an examination of the *gums*. A red, spongy, and tumid state of them is usually denotive of a scorbutic diathesis, especially if it be conjoined with frequent bleeding and hemorrhagic spots in different parts of the body. An eroded appearance of the gums is generally indicative of an accumulation of tartar, while the presence of sordes is expressive of a typhoid state of the system.

Pain in the throat and difficulty of deglutition are evidences of tonsillitis, and of disease or mechanical obstruction of the œsophagus. A careful inspection of the fauces and the introduction of the probang usually readily determine the precise locality of the affection, as well as its nature. In the former case, the tongue is carefully depressed with the handle of a spoon, or a tongue-holder, the mouth being widely opened as the patient sits upon a chair in a strong light; in the latter, the surgeon, standing behind the patient whose head rests upon his chest, carries the instrument gently and cautiously along the tube until it comes in contact with the obstruction, which is not passed all at once, or forcibly, lest undue violence should be inflicted, perhaps eventuating in rupture or ulceration of the œsophagus.

No examination in any case of disease, if at all serious, whether surgical or medical, can be considered as at all complete without a thorough exploration of the condition of the *stomach* and bowels. When it is recollected that disorder of the secretions of these organs, the presence of irritating ingesta, or the accumulation of fecal matter is frequently a source of disease in other parts of the body, as well as in these organs themselves, the importance of an attentive examination of them cannot be too much insisted upon. The insertion of the finger into the rectum, and the use of the speculum often lead to the most useful knowledge of the condition of the anus and lower bowel. An examination of the alvine evacuations not unfrequently reveals important information in regard to the state of the liver, as the presence, absence, or quality of the bile, and the action of the mucous follicles of the alimentary tube, and should never be omitted in any case of serious disease or accident.

Intellect.—The intelligence is often remarkably altered in disease and accident. Delirium and incoherency are common effects of all lesions attended with high arterial excitement. Their character,

degree, and duration vary much in different cases, and are greatly influenced by surrounding and intrinsic circumstances, as the nature of our treatment, the intensity of the morbid action, the importance of the affected organ, and probably also by the idiosyncrasy of the individual. In general, as they are of a purely sympathetic character, they rapidly disappear with the excitement that induced them; coming and going perhaps several times in the twenty-four hours, especially during the vesperal and nocturnal exacerbations which are so liable to distinguish most febrile attacks, whether traumatic or idiopathic.

In organic disease of the brain and its envelops, on the contrary, a different order of things usually occurs. Here the delirium, once fairly begun, continues uninterruptedly, although it may be characterized by intervals of remission; and, as the morbid action progresses, it generally lapses into stupor, and this, ere long, into deep coma, which is but too often the immediate forerunner of dissolution. In compression of the brain, whether from extravasated blood, excessive congestion of the cerebral vessels, effusion of serum, or depression of the cranial bones, the intelligence is commonly completely abolished; the patient is deprived of all sensation and volition, and cannot be roused by the most powerful stimulants. He is, in fact, a mere automaton, dead to all surrounding impressions. If, from any cause, inflammation of the brain or of its membranes arise, the face soon becomes flushed, the eye suffused, the pupil contracted and impatient of light, the skin hot and dry, and the pulse quick, hard, and frequent. Delirium soon sets in; the mind becomes incoherent, and, although questions may still with some effort be answered rationally, yet the patient speedily lapses into his former condition, knitting his brows, tossing from side to side, withdrawing his hand from the attendant, muttering constantly, and falling gradually into a more unconscious state. Rigors generally occur early in the disease, and are always denotive of great danger. If effusion of serum, lymph, or pus take place to any considerable extent, convulsions and deep coma are sure to follow, soon terminating in death.

Countenance.—The state of the countenance is always a subject of inquiry with the intelligent practitioner. The mirror of the soul, it reflects, to a greater or less extent, alike the sensations of pleasure and of pain, of joy and of sorrow, and is thus capable of supplying important diagnostic indications in a great variety of diseases and accidents. To call attention to all the details which necessarily connect themselves with the study of the physiognomy under these circumstances, would be out of place in such a work as this, and I shall therefore content myself by referring to a few of the more frequent and conspicuous.

Excessive pallor of the countenance, especially of the prolabia, is generally denotive of great loss of blood, or of extreme shock of the nervous system. In the latter case it is often associated with a peculiar withered and shrunken expression of the features, reminding one sensibly of the decay of a leaf in autumn. In apoplectic affections of the brain, the face is turgid, flushed, and paralyzed on one side;

causing thus serious distortion, the angle of the mouth being drawn to the opposite side, while the eyelid on the affected side has a drooping appearance, descending hardly half way over the ball. In general inflammatory fever, whether the result of accident or of internal causes, the countenance is red and tumid, the eye is suffused, and the ala of the nose is rapidly dilated and contracted by the hurried inspiration. When the breathing is much embarrassed, as when there is deep congestion of the lungs, or mechanical obstruction to the entrance of the air, as when a foreign body exists in the larynx or trachea, the face is livid and often remarkably puffy, particularly when the affection is of long standing, and accompanied by œdema of the subcutaneous cellular tissue. All painful affections of these organs are characterized by an anxious expression of the features, attended by an unusual dilatation of the nostrils during each act of inspiration, and by a peculiar heaving movement of the chest. "In inflammation of the abdominal viscera," observes Dr. Marshall Hall, "attended with severe pain, the muscles of the face are in a state of continued contraction; the features are unnaturally acute, the forehead is wrinkled, and the brows knit. The nostrils are acute and drawn up; the wrinkles, which pass from them obliquely downwards, are deeply marked; the upper lip is drawn upwards, and the under one frequently downwards, so as to expose the teeth. The state of the features is aggravated on any increase of the pain from change of position or external pressure. When the abdominal pain arises from spasm, the muscles of the face are exceedingly contracted and distorted during the paroxysms of pain; but in the intervals of the paroxysms the countenance assumes a calm and placid aspect."

The diagnostic value of the Hippocratic countenance has long been recognized by practitioners. Its presence is always denotive of extreme danger, and is commonly associated with other symptoms of an untoward import, as twitching of the tendons, high delirium, a dry tongue, sordes on the teeth and gums, and excessive prostration. It consists in a peculiarly sharp, retracted, and withered appearance of the features, and generally attends the closing scenes of all typhoid states of the system, whatever may be their cause or character.

Voice.—The state of the voice often furnishes useful information respecting the nature of the lesions of the larynx and trachea. Its peculiarity in croup is well known, being either sharp and shrill, like the crowing of a young cock, or low, hoarse, and almost extinct, especially if the disease have made considerable progress. In œdema of the glottis, without being always hoarse, it is generally reduced to a mere whisper; and in thickening of the vocal cords and ulceration of the mucous membrane of the larynx partial loss of voice, and ultimately complete aphonia generally attend.

Respiration.—The respiration should always be attentively examined. In all acute diseases, attended with unusual vascular excitement, it is increased in frequency, short, and laborious. In pneumonia and pleurisy it is generally diaphragmatic, the intercostal muscles being almost completely quiescent, with hardly any perceptible elevation and depression of the ribs. The patient, alarmed and anxious, breathes

with great difficulty, dilating his nostrils at every inspiration, and raising the shoulders and upper part of the chest, so as to draw in as much air as possible at each effort. In inflammation of the abdominal viscera, on the contrary, the diaphragm is nearly stationary, while the intercostal muscles are in full play, the act of inspiration being short and panting, lest the descent of the diaphragm should produce an aggravation of suffering by rudely compressing the affected organs. In affections attended with cerebral congestion, effusion of blood, or depression of the skull, the breathing is slow, labored, and irregular; often stertorous, and accompanied by a peculiar whiff. In spasmodic diseases of the respiratory organs, the inspiration is quick and imperfect, as if the patient was unable to dilate the chest, and is usually accompanied with a characteristic wheezing sound, often audible at a considerable distance, during expiration, which is at the same time labored, and protracted. Short, difficult, and anxious breathing, aggravated by muscular exertion, as in ascending a hill, or rapid talking, is generally denotive of hydrothorax and of organic disease of the heart and great arteries.

Heart.—The diagnostic signs manifested by the heart and arteries deserve careful consideration. In examining the pulse, the exponent of the great central organ of the circulation, particular attention should be paid to its frequency, volume, and force, as these constitute the leading features by which the practitioner judges of the state of the system; or, in other words, of the character and effects of the morbid action. To do this properly requires not a little knowledge and experience; for nothing varies more than the condition of the pulse in health and disease. Hence it is not surprising that it should have been pronounced by one of the older physicians to be the most fallacious of symptoms.

Pulse.—In traumatic fever the pulse, as a general rule, is quick, frequent, and hard; and similar qualities usually characterize it in idiopathic affections. The increase in the number of its beats ranges from ten to thirty and even forty in the minute; they are performed with a peculiar sharpness and rapidity, and the blood is sent into the arteries with such momentum as to cause their coats to rebound under the finger, offering thus a decided resistance to its pressure. When this is the case, the pulse is said to be hard. Hardness, quickness, and frequency are often associated with fulness, especially in very plethoric subjects, laboring under intense inflammatory excitement; but such a coincidence is by no means always necessarily present; on the contrary, instances occur where the pulse is so exceedingly small and thready as to require some care to detect it. This is generally the character of the pulse in peritonitis, from whatever cause arising, and therefore affords valuable diagnostic information. In certain affections of the brain, as in compression, whether a result of apoplexy or external injury, the pulse is slow, full, and laboring, as if the heart were oppressed by a heavy load which it found difficult to carry or to shake off. The pulse after hemorrhage is strikingly peculiar, although it is not easy to define its character; it may be described as being very sharp, quick, and thrilling, as if the blood were sent into the artery

with a kind of jerk, imparting thus a vibratory sensation to the finger. Once felt, it is impossible ever to forget it. An intermittent pulse is generally denotive of organic disease of the brain, or of the heart, lungs, or great vessels; sometimes, however, it appears to be the result altogether of functional disease, as dyspepsia, or gastro-intestinal irritation.

In examining the pulse with a view to its diagnostic value, it is to be remembered that it may be naturally slow or frequent, hard or soft, full or small, strong or feeble; depending upon idiosyncrasy, or the effects of previous or existing disease.

The time and mode of examining the pulse require some attention. As a general rule, the surgeon should not put his hand upon the wrist immediately after he has sat down by the side of the bed, as such a course would be likely to cause alarm, and thus lead to erroneous inferences. Nor should he use a watch for the purpose of counting it, especially if the patient be very sick and nervous, as this also might excite injurious apprehension. In fact, it is impossible to conduct the examination too carefully; for unless this be done, the intention of the practitioner will often be completely thwarted, simply in consequence of his awkwardness. At least two fingers should be placed upon the radial artery, and the application should be continued sufficiently long to enable him to determine fully the character of its beats, particularly their frequency, volume, and power of resistance.

Kidneys.—The renal secretion should claim particular attention in every severe case of accident and disease. A very superficial inspection will generally at once detect remarkable deviations from the normal standard, both as it respects the color, quantity, and consistence of this fluid, as well as any tendency it may manifest to the formation of deposits after having stood for some time in the receiver. But if a more thorough investigation be deemed necessary, as when organic disease of the kidney is suspected, or with a view to the detection of the existence of any particular calculous diathesis, a more minute and elaborate examination, conducted with the microscope and chemical tests, will be required; and it need hardly be added that such a procedure generally calls for an amount of knowledge, skill, and experience such as few professional men possess. As this subject will receive special consideration in the chapter on the urine and its deposits, no further allusion to it need be made here.

Finally, the practitioner must not neglect to examine the state of the skin, noting particularly the character of its temperature, the presence or absence of moisture, the degree of its contractility, and any change of color it may have experienced; the condition of the limbs, as to the existence or non-existence of paralysis or injury; and lastly, the state of the genital organs, if, upon inquiry, there is reason to suppose that they are either the seat of the morbid action, or that they deeply sympathize in the disorder of other parts of the body.

SECT. II.—MENSURATION.

An examination of the dimensions of a part occasionally affords valuable aid in determining the diagnosis of its lesions. Such a mode of investigation is particularly serviceable in fractures and dislocations, in coxalgia, and in affections of the chest, especially in pleuritic effusions, so common after accidents and diseases.

The best contrivance for ascertaining the amount of shortening in an injured or diseased limb is the graduated tape, used by seamstresses and tailors, and inclosed in a metallic case, so as to admit of its being carried in the pocket. It is a yard in length by half an inch in width, and being composed of oil-cloth it is perfectly inextensible, thus rendering it admirably adapted to the object. In order to attain perfect accuracy of result, it is necessary that the sound and affected members should be placed as nearly as possible parallel with each other; for if there be the slightest variation in their inclination it must proportionably impair the value of the examination, if not completely destroy it. Thus, for example, in trying to ascertain the amount of overlapping of the fragments of a broken femur, the two thighs should not only be placed parallel with each other, but great care should be taken that they, as well as the buttocks, rest evenly upon the bed, table, or floor on which the patient lies. Finally, in order to perform the operation in the most unexceptionable manner, the additional precaution should be taken of maintaining the head, chest, pelvis, and extremities all in a straight line until the measurement is completed.

After the limbs and body have been adjusted as here described, two fixed points are selected, between which the tape is stretched. Thus, to take the thigh again as an illustration, the two proper points are the anterior superior spinous process of the ilium and the inner border of the patella. The distance between these two prominences having been ascertained upon the affected member, the tape is next stretched between the same points on the sound limb, the difference in the length between the two being the sum of the shortening of the injured bone. Where no fixed points can be obtained, a mark may be made upon the skin either with ink, or nitrate of silver.

The graduated tape may also be employed for measuring the diameter of a limb, as in disease of an important joint, or a suspected morbid growth. Or, instead of this, recourse may be had to the graduated compass of Mayor, which, however, notwithstanding its ingenious mechanism, really possesses no real advantages over the tape. This instrument consists of four pieces, the central one, which is a flat rod, being marked by a scale of inches and lines.

Mensuration of the chest is often practised in pleuritic effusions, although such a means of diagnosis is seldom necessary in the hands of an intelligent and skilful surgeon, auscultation, percussion, and inspection being quite sufficient for the purpose in almost every instance coming under his observation. When more than ordinary care is desired, the graduated tape, extending from the middle of the sternum to the centre of the spine, will readily supply the requisite information.

The plumb-line is occasionally used for determining the existence of curvature of the spine; such an expedient, however, can only be necessary in the earlier stages of the malady, before marked deformity has set in. When the disease is fully established, such a mode of investigation would savor alike of affection and stupidity.

A ready method of determining the angle of an object, as, for example, that of a broken bone, has been suggested by Malgaigne. It consists in applying a sheet of paper, by its edge, to the limb so as to represent its vertical axis. At the point where the axis changes its direction, the paper is so folded as to follow it exactly; the result will be that the salient angle thus formed will necessarily give the entering one caused by the fragments of the deformed bone. In order to determine the degree of this angle, a sheet of paper is folded in four, which "makes a right angle, or 90°; folding again one of the sides affords an angle of 45°; adding this angle of 45° to the unchanged right angle, gives an angle of 135°, and so on. Applying now this extemporaneous quadrant to the already ascertained angle of the fracture, we obtain, without trouble, or loss of time, as accurate an estimate as possible."

SECT. III.—ATTITUDE OF THE PATIENT.

The attitude of the patient and the position of the affected part are variously and often remarkably changed in diseases and accidents, and afford, in many cases, valuable diagnostic indications, not attainable in any other way. The study of the variations in the configuration of the body is of much greater moment, as a means of distinguishing different lesions, than is generally imagined, and has received less attention than its importance merits. In some affections, the diagnosis absolutely hinges mainly, if not entirely, upon the attitude assumed by the patient in consequence of the morbid action. We need only instance the peculiar distortion of the body in tetanus, caused by the continued and violent contraction of the muscles, drawing the trunk, in one case, powerfully forwards, in another backwards, and in a third to one side. No one that has ever witnessed this change of configuration can possibly mistake it in a similar attack; for there is no other lesion capable of producing it. In caries of the vertebræ, usually known as Pott's disease, and in lateral curvature of the spine, the result of irregular muscular action, the distortion of the body is characteristic. In coxalgia, the flattening of the hip, the elevation of the pelvis of the affected side, the retraction of the heel, and the effacement of the femoro-gluteal fold are among the most valuable diagnostic signs of the malady.

In diseases and injuries of the chest, the position of the patient is often highly characteristic. In inflammation of the lungs and pleura, attended with slight effusion, he generally lies either on the affected side, or else upon his back, not on the sound side, as the weight and pressure of the diseased organ would seriously impede respiration and excite violent coughing. In hydrothorax, with large accumulations on

both sides, the patient is obliged to raise his head and shoulders very much, or even to sit up in bed, in order to obtain the requisite supply of air. When he lies down the effused fluid is diffused over a larger portion of lung, an occurrence which is instantly followed by increased difficulty of breathing, and by the necessity of a change of posture to prevent impending suffocation. "When out of bed, he is often observed to sit with the arms placed along the side, and the hands fixed and pressing forcibly on the chair or sofa on which he rests; in other cases he leans a little backwards, still supported by the arms and hands, which are pressed behind his back."

The attitude assumed by the patient in inflammation of the abdominal and pelvic viscera is generally very striking and characteristic. Unable to shift his position, he lies constantly upon his back, with his head and shoulders considerably elevated, the knees raised, and the thighs partially flexed, the object being to relax the abdominal muscles in the greatest possible degree, so as to take off their weight and pressure from the inflamed surface. In spasmodic affections, on the contrary, the position of the patient is altogether different; instead of observing dorsal decubitus, he lies at one time on this side, and then on the other, now on the back, and next on the belly; and instead of avoiding pressure he actually courts it, not feeling comfortable without it. Hence, he often doubles himself up, and twists and contorts his body in almost every possible manner, in order to obtain relief.

In stone of the bladder, impeding the flow of urine, the attitude of the patient is frequently very singular. Sometimes he is compelled to assume a stooping posture; at other times he crosses or separates his legs, inclines his body to one side, lies down, rests on his elbows and knees, or lies on his back, and throws up his buttocks. In traumatic and other affections, attended with typhomania, retention of urine may be suspected, if the patient lies on his back with the limbs retracted. In acute inflammation of the kidney, the body is generally inclined a little forwards and towards the affected side, so as to relax the lumbar muscles, and take off any pressure they might otherwise exert upon the diseased organ.

The nature of an accident is not unfrequently revealed by the attitude of the part and body; sometimes by the one, sometimes by the other, and occasionally by both. Thus, the manner in which the patient inclines his head and supports his arm in fracture of the clavicle is so peculiar as to be absolutely, in great degree, pathognomonic of the nature of the lesion. Dislocations of the shoulder, hip, and other joints, are denoted by striking, if not characteristic changes in the attitude of the body and limb. The existence of a fracture is often revealed by a peculiar change in the conformation of the affected member, consisting either in a marked shortening, or in a peculiar alteration in the axis of the part. The disease called wry-neck derives its name from the peculiar twist of the neck by which it is distinguished.

SECT. IV.—EXTERNAL CHARACTERS.

Important diagnostic data are sometimes furnished by the color, form, consistence, mobility, pulsation, temperature, crepitation, sensibility, or odor of a part; and by the spots, scars, or ulcers existing upon its surface. A mere glance at these different topics will serve to show their value as means of distinguishing morbid action, whether it be considered simply in reference to its nature, or its nature and degree.

Thus, as stated under the head of inflammation, the *color* of the diseased part may be scarlet, as in inflammation of the mucous membrane of the fauces; lilac, as in sclerotitis; grayish, or brick-colored, as in iritis. When the redness occurs in the form of a streak, extending up the arm or leg, it is denotive of phlebitis, or of angeioleucitis. Diffuse discoloration characterizes erysipelas; circumscribed discoloration, boils and carbuncles. A scarlet hue implies great vascular activity, such as exists in acute inflammation; a purple hue, on the contrary, denotes partial stasis of the blood, which, if not soon arrested, may lead to gangrene.

Change in the *form* of a part may be caused by swelling, as in inflammation attended with effusion; or it may depend upon the pre sence of a new growth, or it may be the result simply of hypertrophy. In fractures it is caused by displacement of the ends of the fragments; in dislocations by the presence of the head of the bone in its new situation. In hernia, very striking changes generally attend the figure of the affected parts, especially when the protrusion is old and unusually bulky.

Extraordinary *consistence* of a part is indicative either of excessive induration from inflammatory deposits, particularly semi-organized lymph; or of the presence of a solid tumor, or a displaced bone. When the part is unusually soft, the alteration of consistence may depend upon the presence of pus, fluid blood, serum, or serum and lymph, and often requires the closest scrutiny for the successful detection of its precise character. Under such circumstances the history of the case frequently affords important diagnostic data, especially the age of the accumulation, and the presence or absence of inflammatory symptoms. If the part fluctuates distinctly, and is, withal, red, tender, or painful, the probability is that the alteration of consistence is due to the existence of pus; if, on the other hand, it be perfectly free from discoloration and uneasiness, although the undulation under pressure may be most perfect, the conclusion must be that the disease is either a chronic abscess, or else some serous, or hematoid cyst.

The *mobility* of a part may be diminished or increased, thus throwing important light upon the nature of the case. As a general rule, it may be stated that it is lessened in dislocations, and augmented in fractures. The value of this symptom is well shown in diseases of the articulations, as well as in inflammation of other parts of the body, which, if at all seriously involved, have their mobility always proportionably diminished. In malignant tumors, loss of mobility of the

morbid growth generally forms a prominent phenomenon in the advanced stage of the disease, in consequence of the firm adhesions that take place between it and the surrounding structures. A similar effect may be produced by the manner in which such tumors are bound down by the aponeuroses and muscles. In affections of the eye an alteration of the mobility of the iris often affords most important diagnostic information.

Abnormal *pulsation* in a part leads to the suspicion of the existence of aneurism, and this suspicion will almost be converted into certainty, if, in addition to this phenomenon, there is a peculiar thrill, with a vibratory sensation, and a decided diminution of the volume of the part upon the application of pressure to the cardiac side of the artery supplying it with blood. The mere fact of the existence of abnormal pulsation should put the surgeon upon his guard, in order that, by redoubling his efforts at a thorough exploration, he may not commit any errors of diagnosis; laying open, perhaps, an aneurism when he supposes that he is dealing only with an abscess or a hygroma.

The surgeon occasionally meets with what is denominated *crepitation*, a rough, grating, or friction sound, of great value as a diagnostic in fractures, emphysema, and inflammation of the sheaths of the tendons. In many cases it may be both felt and heard. In fractures it is produced by rubbing together the ends of the broken bone, and is generally so distinct as to be completely characteristic of the nature of the lesion. In order to elicit it, a good deal of management is often necessary; but in general it will be sufficient, after the ends of the broken bone have been fairly placed in contact, to grasp one piece firmly, and to hold it so while the other is rotated on its axis; or both fragments may be moved simultaneously in opposite directions.

The crepitation of emphysema is a kind of crackling sound, similar to what is produced by the rumpling of dry parchment, or by rubbing together numerous little dry, friable balls filled with air. The part, moreover, feels soft and puffy, and the contained air may be easily pressed from one spot to another.

Bony tumors of the antrum of Highmore and of the lower jaw, attended with great expansion and attenuation of their walls, occasionally emit, when pressed between the fingers, a peculiar crackling noise, similar to that of dry parchment. The sound thus elicited, however, is altogether different from crepitation, properly so termed, and its chief value consists in showing the alteration which the osseous tissue is capable of undergoing when it is subjected to long continued eccentric pressure.

The crepitation attendant upon inflammation of the sheaths of the tendons is altogether different from the two preceding varieties, resembling the sound caused by rubbing dry starch between the fingers. When the disease is chronic it may sometimes be both heard and felt. It evidently depends upon the presence of plastic matter, and is most common about the wrist and ankle. This sound is often closely imitated in affections of the mucous bursæ, especially when they are pretty well distended with fluid, intermixed with flakes of lymph and fibrinous concretions.

A faint crepitating sound is sometimes produced by breaking up the clots of a sanguineous cyst, and rubbing the fragments between the fingers. The noise, when it does occur, is always most distinct at the base of the tumor, where most of the solid matter is necessarily collected.

An alteration of *temperature* in parts affected with disease is sufficiently common, and occasionally affords valuable diagnostic intimations. With what interest does not the surgeon watch the rise of heat in a limb after the ligation of its principal artery! A casual examination is generally sufficient for its detection; when more than ordinary nicety is required, recourse may be had to the thermometer. The intensity of the morbid action may sometimes be pretty accurately measured by merely observing the increase of its temperature. A sudden diminution of temperature, in a part previously in a high state of inflammation, may generally be regarded as an omen of unfavorable import, as it is denotive of the approach of gangrene.

An increase of the *sensibility* of a part is a frequent, if not an almost constant occurrence in disease, especially when it is of an acute character. In ophthalmia, the slightest ray of light is a source of distress to the patient; in otitis, the ear is intolerant of sound; and in gastritis the stomach is oppressed by the smallest quantity of fluid, however bland, or however cautiously used. Parts, such as bones and ligaments, that are perfectly devoid of feeling in health, often become exquisitely sensitive in inflammation; and thus it is that the practitioner is not unfrequently enabled to detect the existence of morbid action in structures hidden from view, much better than he can in any other manner. The proper way of ascertaining the existence and amount of morbid sensibility is to make gentle and methodical compression, or to percuss the affected part, so as to communicate to it the vibrations of the whole hand, or, what is preferable, of one of the fingers.

When pain exists, a careful distinction should be drawn between that which arises from inflammation and that produced by spasm and neuralgia. In inflammation, the pain is steady and persistent; increased by motion and pressure; commencing with the morbid action, keeping regular pace with it, and gradually disappearing as the morbid action declines. In spasmodic affections, or colic, on the contrary, the pain is paroxysmal, or marked by distinct intermissions; abrupt, both in its invasion and departure; relieved by pressure, and change of posture; and generally attended with flatulence of the stomach and bowels. In neuralgia, the pain occurs in transient and violent paroxysms; darts along the course of the affected nerves with the rapidity of lightning; and is usually accompanied by more or less tenderness of the part, without any distinct tumefaction, discoloration, or augmentation of temperature.

Finally, there are certain affections which may sometimes be readily diagnosticated by a careful examination of the *cutaneous* surface, and that of the mucous outlets. Thus, if there are copper-colored eruptions upon the skin, and excavated ulcers on the fauces, or tubercles upon the tongue, cheek, or lip, no one could fail to conclude that the system was laboring under a syphilitic taint. Partial or complete

destruction of the uvula, tonsils, or arches of the palate, would inevitably lead to a similar inference, especially if, added to this, there is evidence of actual disease. Scars upon the cutaneous surface, scattered irregularly about, large, deep, white, and permanent, are generally denotive of the former existence of rupia.

The character of an ulcer will sometimes lead to the detection of its cause, or to the state of the system which has induced its development. Last autumn a girl, aged fourteen, was brought to my Clinic at the Jefferson College, on account of a large chronic ulcer seated in front of the leg, directly over the tibia; it had been in progress for the better part of a year, was excessively painful, and had resisted a great variety of local and constitutional remedies. Having brought the patient under the influence of chloroform, I scraped away a thick mass of semi-organized substance which formed the bottom of the ulcer, together with the carious and softened portion of the bone; and when she returned to me a week afterwards I was struck with the remarkable improvement that had taken place both in the part and system. Shortly after her visit, however, not less than five or six small unhealthy-looking ulcers, with thick, everted edges, and a foul, nasty surface, broke out around the old one, which by this time had also changed for the worse. Convinced that the disease was of a syphilitic nature, I placed the patient, without any further inquiry into the case, upon the use of iodide of potassium and bichloride of mercury, under the influence of which, and a nourishing diet, she rapidly regained her health and strength, with good sound cicatrices.

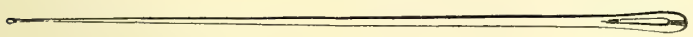
Thus it will be perceived that the diagnosis in this case, founded upon the appearance and obstinacy of the patient's ulcers, was confirmed by the result of the treatment employed for their cure.

SECT. V.—INSTRUMENTAL EXPLORATIONS.

There are certain affections whose character can be ascertained only by a careful examination with the aid of instruments, full access to them in any other manner being impracticable. The instruments mainly required for this purpose are the probe, bougie, sound, speculum, stethoscope, and exploring needle, each of which will therefore demand some notice.

Probe.—The probe (fig. 73) is chiefly employed for the purpose of exploring fistulous tracks and sinuses, the course of balls, and the

Fig. 73.



presence of foreign bodies. It may therefore be considered as a highly valuable instrument, one which is daily and hourly brought into requisition by the surgeon in extensive practice. It is generally made so as to be flexible, being composed of silver, or other suitable metal;

and varies in length, diameter and shape according to circumstances. The ordinary pocket probe is about five inches in length, and of the diameter of a crow-quill, one extremity being blunt, the other somewhat pointed, or furnished with an eye. For exploring the lachrymal passages a much more delicate instrument is required; the uterine probe, on the contrary, is very large; a long and rather stout instrument is generally employed for ascertaining the existence of a foreign body in the air-passages after having opened the trachea, for tracing the course of a ball, and for exploring certain varieties of fistules and sinuses.

The *index finger*, when sufficiently long, and not too thick, is the best probe of all, as the information furnished by it is generally much more reliable than that supplied by a metallic instrument. It is particularly available in the examination of the vagina, uterus, and rectum, whether the object be to detect the presence of disease, malposition, or the existence of an extraneous body.

The *rectal touch*, performed with the index finger, is constantly practised by the surgeon in sounding patients for stone in the bladder, with a view not only of ascertaining the presence of the foreign substance, but also for the purpose of determining its size and situation. Enlargement of the prostate gland, and the existence of calculi in its substance, can seldom be satisfactorily diagnosticated in any other manner. Displacements of the uterus, pelvic tumors, and malformations of the internal genital organs, are often promptly detected by the rectal touch; and there is no practitioner that does not employ the finger in suspected disease of the anus and lower bowel. The rectal touch can readily discriminate between a hemorrhoidal tumor and a carcinomatous growth, a polyp, a prolapsus of the mucous membrane, or a foreign body. The extent of the spasmodic contraction of the anus, which attends fissure of that outlet, is generally readily ascertained by the insertion of the finger.

The *vaginal touch* affords important information in relation to the diseases of the vagina and uterus. It is in this manner that the practitioner ascertains the existence of the various kinds of tumors that are liable to form in these organs, whether benign or malignant, and also the different displacements to which they are subject. A practised finger will readily detect a carcinomatous ulcer of the uterus, a rent in the vagina, and a calculus in the bladder.

Whatever instrument be employed, it should be well oiled and warmed, to facilitate its introduction, and great care should be taken to pass it along in as gentle and easy a manner as possible. If the parts requiring to be explored are inflamed and tender, it may be necessary, before undertaking the examination, to lessen the sensibility by preliminary treatment, consisting of soothing measures, otherwise it may be productive of severe pain and an aggravation of the disease. No general rules can be laid down respecting the position of the part or of the body during the examination, although it must be sufficiently obvious that this is a matter of paramount importance to a satisfactory result. In exploring fistulous tracks it is occasionally necessary to enlarge their orifice somewhat, in order to afford a more ready passage to the instrument or finger.

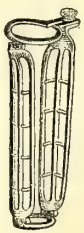
Bougie.—For ascertaining the condition of the mucous outlets of the body, as the urethra, œsophagus, and rectum, a bougie, which is but another name for a probe, is generally employed, the principle upon which the examination is conducted being the same as in exploring a part with the probe, properly so called; that is, the instrument, which is either straight or curved, and composed of gum elastic or metal, is well oiled and warmed, and then carefully introduced as far as the seat of the obstruction, the distance between which and the external orifice is now determined by looking at the graduated scale upon the surface of the bougie, or by making a scratch upon it with the nail. The examination is completed by insinuating the instrument gently into the stricture, so as to measure its extent, and the degree of its resistance. The information thus elicited is generally of the greatest diagnostic and practical value.

Sound.—The instrument employed for exploring the bladder is called a sound, although it is in reality nothing but a probe, blunt pointed at the distal extremity, and a good deal curved, so as to adapt it to the course and shape of the urethra. It is composed of steel, being perfectly smooth, and of a round shape. Its object and mode of use will claim special attention in connection with the diagnosis of vesical diseases, which could not be established satisfactorily in any other way.

Speculum.—Of the value of the speculum as a means of diagnosis in affections of the vagina, uterus, anus, nose, and ear, it is unnecessary to say anything of a formal character, as it is fully appreciated by every sensible practitioner. Indeed, it is only surprising when we consider the great aid which we derive from its use that its employment should still be so much restricted, as it seems to be, in certain parts of this and other countries. Invented at an early period of the science, it was completely lost sight of for many ages, until it was re-introduced, about thirty years ago, to the notice of the profession by Recamier, who thus conferred an inestimable benefit upon the public.

The speculum is composed of polished metal, or of glass, and consists either of a cylinder, or of two, three, or four movable blades, secured by screws, and furnished with an appropriate handle. A wire speculum (fig. 74) is sometimes used. For most purposes to which such an instrument is applicable the cylinder answers exceedingly well, and it possesses the additional recommendation of simplicity of construction, convenience, and cheapness. The valvular speculum, on the contrary, is a complicated contrivance, expensive, and liable to get out of order. Nevertheless, there are certain forms of disease, especially of the uterus, which hardly admit of satisfactory exploration by any other means. Whatever form of instrument be selected, it should be well oiled and warmed, and then carefully inserted into the cavity which it is designed to explore, the patient having been previously placed in the most eligible position for undergoing the examination. Unless the case is one of unusual urgency, the examination should always be put off until there is a clear day, as the light of the

Fig. 74.



sun is far better, as well as more convenient, than an artificial one. In exploring the uterus, the touch should precede the introduction of the speculum, with a view of ascertaining the existence or non-existence of any displacement of that organ.

I have never found it necessary to use an oral speculum, an instrument occasionally met with at the cutler's shop. Making the patient take a full inspiration, while he holds his mouth wide open, will generally permit a thorough inspection of the tongue, cheeks, and fauces; where greater nicety is required the tongue may be depressed with the handle of a spoon, a spatula, or a tongue-holder, and the tonsils and arches of the palate separated by means of a director or a long probe.

Exploring needle.—The value of the exploring needle cannot be too highly appreciated by the practical surgeon, as he is obliged to use it in the examination of a great variety of external affections, the diagnosis of which does not admit of accurate determination in any other manner. On the other hand, however, there is reason to believe that there is no instrument, certainly none of its size, that is more frequently misapplied by the uninformed practitioner, or one which may do a greater amount of harm when used without proper judgment and discrimination. Like everything else that is good, it is liable to abuse; a circumstance which cannot be too strongly impressed upon the mind of the young surgeon. I am sure I have seen immense injury and even loss of life produced by its careless and reckless use.

Numerous exploring instruments are in the hands of the profession; some of which, displaying great delicacy and ingenuity, seem to combine all the advantages that such contrivances are capable of affording, while others are extremely clumsy, and, consequently, very imperfectly adapted for the purpose they are designed to fulfil. The great fault with most of them is that they are too large, thus inflicting an amount of injury upon the affected part, which, especially in malignant diseases, is often followed by the most disastrous effects, causing, perhaps, not merely severe pain and hemorrhage, but such a change in the vital relations of the morbid growth as to lead to its rapid development, if not to the speedy destruction of the patient. I recollect seeing, some years ago, a tumor upon the hip of a lad, aged sixteen, which, after having been subjected to various examinations by highly respectable surgeons, was at length pierced with a large exploring needle. The swelling, which had been supposed to be nothing but a chronic abscess, and which for some time had been almost stationary, now rapidly increased in volume, ulcerated, and fungated, and in less than a fortnight destroyed life. Dissection showed that the morbid growth was one of the encephaloid kind, the activity of which had been greatly augmented by the changes induced in its vital relations by the injury done by the instrument. A large volume might be filled, if one had time, with a rehearsal of the mischief that has been committed by the exploring needle in the hands of careless and unscrupulous practitioners.

Exploring needles consist either of a solid cylinder or of a species of trocar and canula; sharp-pointed, fine, and perfectly smooth, so as

to facilitate their introduction and easy management. They are made of various lengths and diameters, according the depth, volume, and nature of the part to be examined. The annexed cut (fig. 75) represents

Fig. 75.



an exploring needle, with a lateral groove. The best instrument of the kind, according to my experience—one which answers every purpose in superficial affections, and which may always be used with the most perfect safety—is the ordinary cataract needle, spear-shaped, and sufficiently stout to prevent it from breaking. This is inserted into the most prominent portion of the tumor or morbid accumulation, with a sort of rotatory motion, the object being to condense, as it were, the edges of the opening to promote the escape of the contents of the swelling, which readily occurs, if they are of a fluid consistence, a drop of the liquid often adhering to the instrument, or resting upon the orifice of the little puncture. When the contents are of a semi-solid nature, or the tumor is very deep-seated, the needle should be larger, or, what is preferable, it should be replaced by a very small trocar, long enough to reach and penetrate the affected structures. Whatever instrument be used, it must not, on any account, be permitted to come in contact with any important vessels or nerves. When the swelling is of unusual bulk, it may be explored at several points of its extent at the same sitting. The little puncture made in the operation should be immediately closed with adhesive plaster or collodion. When the object is to exclude the entrance of air, the instrument may be carried some distance between the integument and the swelling, so as to make the opening somewhat valve-like.

Dr. Addinell Hewson, of this city, has invented an exploring instrument for the purpose of removing a small portion of the tumor, or morbid deposit, with a view to a microscopical examination of its structure, the tube which he employs for this object being furnished with a peculiar contrivance attached to the rod which slides in its interior. Such a procedure, it strikes me, is more ingenious than useful, as its disturbing influence upon the morbid mass can hardly fail, at least occasionally, to impart new life and energy to the affected tissues.

Ophthalmoscope.—Another instrument has recently been added to our diagnostic armamentarium; this is the ophthalmoscope, of which due mention will be made in the proper place. Whether the high expectations anticipated from its use will be fully realized time alone can determine.

Stethoscope.—The use of the stethoscope, as a means of surgical diagnosis, is comparatively limited, and it might be altogether dispensed with by those who have a well practised ear, and are not averse to the employment of immediate auscultation, or the direct application of the ear to the affected parts. Lisfranc thought that the

stethoscope might be advantageously resorted to for the purpose of detecting crepitus in deep-seated fractures; or, what is the same thing, in fractures covered by a large amount of muscular and other tissues, as, for example, in those of the neck of the thigh-bone in very fleshy subjects. Few occasions, however, can arise in which such a mode of exploration can be of any real service, and I am not aware that any of our more experienced practitioners ever employ the instrument with this object.

Laennec, long ago, proposed auscultation as a means of detecting the presence of calculi in the bladder. He thought that it would be particularly serviceable in ascertaining the existence of very small concretions, which, when struck with the sound, emit only a very indistinct noise; and he suggested that, under these circumstances, the stethoscope should be applied to the pubic or sacral region while the instrument was being freely moved about in the organ. The recommendation, however, has not met with any particular favor, and there are, I suppose, few surgeons who would feel inclined to cut a patient for stone on such slender evidence of its presence.

The chief value of auscultation, then, is restricted to the examination of diseases of the heart, pericardium, lung, and pleura; and to the investigation of certain lesions of the abdomen, uterus, and ovaries, simulating pregnancy, with a view to the detection of the fœtal circulation. Dry tapping, as it has been emphatically called, would probably be of much less frequent occurrence, if the stethoscope were oftener employed in supposed dropsy in young unmarried females.

SECT. VI.—EXAMINATION OF THE DISCHARGES.

The discharges, normal and abnormal, from different parts of the body, often furnish the surgeon important diagnostic information. Thus, an habitual flow of tears over the cheek is usually denotive of disease of the lachrymal passages, and necessarily suggests the propriety of a careful examination of them with a view to the detection of obstruction. For a similar reason the surgeon is prompted to inspect the ear in otorrhœa, and the nose when it is the seat of mucopurulent profluvium. The very nature of the discharge informs him of the existence of inflammation, but how that inflammation is produced, whether by the presence of a foreign body, a piece of dead bone, or a polyp, is a question which can only be decided by the most careful scrutiny; requiring, perhaps, the employment of the syringe to wash away the secretion and repeated inspection before the precise nature of the case can be satisfactorily made out. One of the most important symptoms of inflammation of the maxillary sinus is a flow of pus into the throat; but no surgeon can be certain that it proceeds from that cavity unless he has previously ascertained that there is no disease of the mucous membrane of the nose.

The character of the *sputa* has long been an object of study with practitioners on account of the useful information which they afford in regard to the existence of particular diseases. Such information is

hardly of less value to the surgeon than to the physician, as it apprises him of the presence of lesions which forbid surgical interference, or place him in possession of useful data respecting the occurrence of pulmonary complications, so common after accidents and capital operations. The reddish streaks in the expectoration excite suspicion of the existence of pneumonia; the rust-colored sputa confirm that suspicion, and at once invest the case with its proper importance. The fetid putrilaginous matter coughed up in gangrene of the lungs is characteristic of that disease, from whatever cause proceeding. In phthisis, after the occurrence of caverns, the expectorated matter is ejected in distinct rounded masses, with irregular and indented edges; it sinks in water, and is of a yellowish color, with various shades of ash and even green, and streaked with opaque specks. A discharge of blood by vomiting is denotive of hemoptysis when the fluid is of a scarlet color, and of hematemesis, when it is perfectly black. In affections of the throat, attended with thick mucous, or muco-purulent secretion, the sputa are sometimes streaked with blood. The saliva in mercurial stomatitis has a characteristic odor, and the same is true of the discharge which accompanies gangrænopsis.

A thick yellowish discharge, more or less abundant, from the *vagina*, is indicative of inflammation of that canal, of the uterus, or of both, and the addition of blood may usually be regarded as an evidence of concomitant ulceration. In the virtuous woman such a profluvium is generally to be considered as the result of accidental causes; in the courtesan, on the contrary, it at once awakens a suspicion of the existence of gonorrhœa or chancre. In cancer of the womb, the disease is attended, in its earlier stages, by hemorrhage, and afterwards, when ulceration has set in, by a foul, purulent, or sero-sanguinolent discharge, more or less copious, and so excessively fetid as to indicate unmistakably the character of the lesion.

In the male, a discharge of matter from the *urethra* generally furnishes useful information respecting the character of the disease under which the individual is laboring. When the discharge is thick, yellowish, and abundant, it is denotive of gonorrhœa, or chancre, though in the latter case it is seldom very profuse; when thin, and lactescent, or like the white of an egg, it indicates the existence of gleet, or prostatorrhœa. A large and sudden discharge, especially when no profluvium precedes or follows it, is to be taken as an evidence of spermatorrhœa.

The presence of *spermatozoa* in hydrocele sometimes throws important light upon the source of the water. It has been ascertained that whenever the fluid contains animalcules of this kind, the disease is generally of an encysted nature; for, although they also occur in ordinary hydrocele, yet the circumstance is so uncommon that it must be regarded as altogether of an exceptional character.

Of the signs afforded by the *renal* and *urinary secretions*, as evidences of disease, either of a local or general character, proper mention will be made in the chapter on the affections of the urinary organs. Here I shall only add that a careful examination of these secretions is often a matter of paramount moment to the surgeon, especially when

he is obliged to decide respecting the propriety of a severe operation, the result of which might be seriously compromised by the existence of organic lesion either of the kidneys, or of some other important viscera. Hardly any man, however reckless, would enter upon such an enterprise if the urine were loaded with albumen.

The existence of disease of the *anus* and rectum, and even the true nature of such disease, may often be satisfactorily inferred by the discharges furnished by these parts. A flow of pure blood, especially during defecation, is generally denotive of internal hemorrhoids; so also if there be frequent evacuations of thick, bloody mucus, either while the person is at the water-closet, or in the intervals of his visits. A narrow, compressed, or flattened state of the feces is indicative of mechanical obstruction, occasioned either by stricture of the rectum, enlargement of the prostate gland, or contraction of the anus. In ulcerated cancer of the lower bowel, the discharges are generally very profuse, of a muco-purulent nature, mixed with blood and mucus, and excessively fetid; in fact, characteristic of the nature of that horrible malady.

The matter of certain *abscesses* serves to point out their nature and situation, or their accidental communication with neighboring parts. Thus, in the mammary gland, the fluid may contain milk; in the liver, bile; in the kidney, as when an opening takes place externally, urine. Abscesses of the wall of the abdomen have been known to contain biliary calculi; of the joints, fragments of cartilage and bone. In acute abscesses, the contents are thick and yellowish; in chronic, or strumous, thin and slightly greenish, with an intermixture of small, opaque, whitish flakes, resembling grains of boiled rice.

The discharges accompanying *ulcers* generally afford valuable hints respecting the kind of action that is going on in them. Healthy granulating ulcers, or wounds, always yield a thick yellowish pus, possessing all the properties of laudable pus, as described under the head of suppuration; when, on the contrary, their action is unhealthy, the discharge is thin and bloody, ichorous, or sanguinolent, and more or less irritating. In cancerous ulcers, the discharge is generally profuse, foul, devoid of pus globules, and excessively fetid. In ulcers of the bones, it is ichorous and irritating; never healthy, so long as there is any diseased osseous tissue.

The *odor* emitted by a part in a state of disease sometimes supplies important data for the diagnosis of a case. Most readers are familiar with the remarkable anecdote related of J. L. Petit. Travelling through Germany, this distinguished surgeon, while stopping at an inn to change horses, was struck with the odor of gangrene, which he distinguished from several others, hardly less offensive. Not understanding the language of the country, he made his wishes known to a female who showed him into an adjoining room, where he found a man apparently moribund from a mortified intestinal hernia. Happy in being able to render him some assistance, he carefully dressed the parts, and meeting, before he set out upon his journey, with a French physician, he instructed him in the future management of the case. Upon his return,

five months afterwards, he had the gratification to learn that the man had completely recovered his health without a stercoraceous fistule.

The odor attendant upon ozæna is characteristic; no one that has ever perceived it can mistake it. The contents of an abscess at the verge of the anus always emit a fecal smell; a peculiar fetor accompanies the formation of a urinary fistule; and no one can be deceived by the odor of the breath in salivation. In hospital gangrene the stench is so remarkable that, once noticed, it can never be forgotten, although it is so unlike everything else of the kind as to render it impossible to define or describe it. The odor which accompanies gangrene of the mouth of children is unmistakable. The diagnosis of ulcerated cancer of the uterus can often be established by the sense of smell alone. Large wounds in a state of profuse suppuration not unfrequently exhale a peculiar nauseous or sickening odor, in some degree characteristic of the action attending them. The pus of a scrofulous lymphatic ganglion, for a long time pent-up, is sometimes horribly fetid. A smell, similar to that of a macerating tub, often attends abscesses depending upon caries of the spine. In all these cases, as well as in many others that might be adduced in illustration of the subject, it is probable that the peculiarity of the odor is due partly to the generation of sulphuretted hydrogen gas, and partly to the admixture of the natural secretions of the structures affected.

SECT. VII.—MICROSCOPICAL EXAMINATION.

The study of surgical affections has been much advanced of late years by the use of the microscope, the improvements in which during the last quarter of a century have been so important as to have actually established a new branch of science. Discoveries and investigations made by means of this instrument must be alluded to in connection with nearly every form of disease, and its aid will often be found essential to the complete study of particular cases occurring in practice. A concise description of the different varieties of microscopes, and their employment, will therefore be not out of place here.

The fundamental principle of all appliances for assisting vision is to be found in the refractive power of certain media upon rays of light. Glasses, generally of a lenticular shape, single or combined, are the media chiefly employed; either natural or artificial light being available for our purpose. The light is very commonly concentrated and intensified by means of lenses or mirrors.

The student should bear in mind that it is not the object which is magnified, but merely the image impressed upon the retina. The rationale of this enlargement may be briefly set forth as follows: Let a single lens, convex on both sides, be used to examine an object so small as to be just perceptible at the ordinary distance of distinct vision, say nine or ten inches from the eye. The eye, the lens, and the object being in their proper relations to each other, the rays of light coming from the object will so converge in passing through the lens as to form a distinct image upon the retina; in other words, the object

will be seen by the eye as if it were an object of much greater size, placed at the point of ordinary distinct vision. When this occurs, the object is said to be *in focus.* The space thus presented to the eye is called the *field.*

In a single lens the rays of light towards the circumference of the field are always prismatically colored to a greater or less degree; this is very marked in what is known as the Stanhope lens; and portions of the image will also be indistinct, from the fact that by such a lens all the rays are not brought to foci equally distant from the eye. These two phenomena are called, respectively, *chromatic* and *spherical aberration;* they are to a great degree obviated in the Coddington lens, which is composed of a sphere of glass, having at its equatorial line a deep groove, filled with opaque matter; thus the central aperture is limited.

Now, as was before stated, all our means for obtaining magnified views of objects are based essentially on the same optical principle, namely, the refraction of light. The microscopes ordinarily used are of the kind called *double;* which means that the image of an object, magnified by a lens or set of lenses, is again magnified before it reaches the eye. Here let it be distinctly understood that a *single* microscope may consist of any convenient number of lenses, provided they form but one set. The lens or set of lenses forming the first magnified image constitute the *object-glass*, and are so arranged as to obviate the chromatic aberration before alluded to. The *eye-piece* consists of a lens or *eye*-glass, by which the image transmitted by the object-glass is again magnified; and of another lens at some distance below the eye-glass, in order so to change the direction of the rays as to allow more of the object to be seen at once—in other words, to enlarge the field—whence it receives the name of *field*-glass; between these two glasses is placed a *stop* or *diaphragm*, with a central aperture, for the purpose of arresting the circumferential rays, and thus correcting both the spherical and the chromatic aberration. The eye-glass, diaphragm, and field-glass, fastened in their proper relative positions in a tube, thus constitute the *eye-piece*, which fits accurately into another tube; at the lower end of this latter tube is secured to it the one holding the object-glass; and these three portions, the eye-piece, the object-glass, and the tube into which they both fit, constitute the *compound body.* In the manufacture of microscopes, the proper relation of all the parts is ascertained upon optical principles, that is, the instrument is said to be *corrected;* sometimes, in order to compensate for certain conditions, it needs *over* correction, and sometimes, again, it needs *under*-correction. The compound body, thus constituted, itself fits into a tube connected with the stage of the microscope; this latter tube and the stage being either fixed vertically, or capable of oblique inclination by means of a cradle-joint. The *stage* just mentioned is a plate upon which the specimen to be examined is laid, as will be presently stated. The stand of the microscope is that portion which supports the stage and compound body; it must be somewhat heavy, so as to give firmness to the instrument. The annexed cut (fig. 76) represents an excellent pattern for a microscope; it is known as the "Smith and Beck," and combines great strength and steadiness with facility of manipulation.

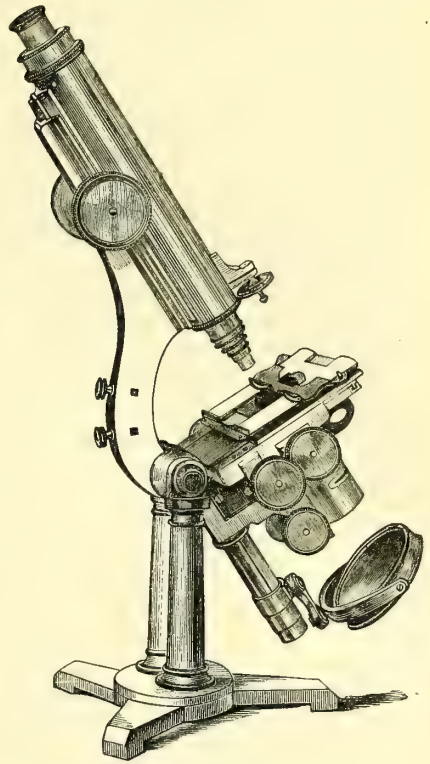
Objects are studied by transmitted or reflected light; in the former case a mirror is placed below the stage, which is of course perforated; the mirror is movable around one or both of its horizontal diameters, so as to catch light from any required quarter, and throw it up through the aperture in the stage, and through the object, as in fig. 77. If reflected light is to be used, the opening in the stage is closed up, and a double convex lens, or "bull's eye," is employed to concentrate the light upon the object.

It is necessary, in examining objects by transmitted light, to be able to limit the amount of light coming from the mirror; every microscope should therefore be provided with a diaphragm-plate below the stage. This is a metallic plate, perforated with holes of different sizes, so arranged as to pass in succession under the opening in the stage, when the plate is rotated.

The alteration or adjustment of the focus is variously performed in different microscopes. In some the compound body is acted on by two milled heads, one large, with a rack and pinion movement, named the *coarse* adjuster; the other smaller, with a screw movement, called the *fine* adjuster. In others the compound body is worked up or down merely with the hands, and the stage is made movable by means of a screw with a milled head.

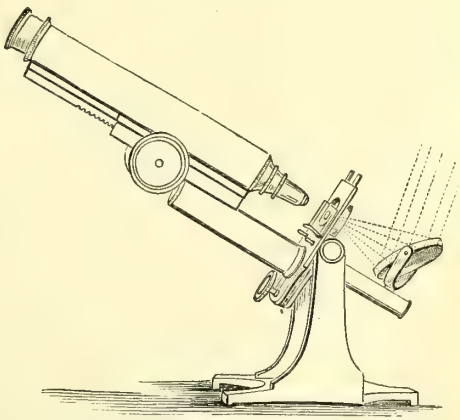
Various methods are also adopted for moving the object so as to bring different

Fig. 76.



Smith and Beck's large compound microscope.

Fig. 77.



Arrangement of microscope for transparent objects.

portions of it into the field. Sometimes the fingers alone are used; sometimes a lever and universal joint, or a set of screws, acting upon the stage so as to carry it in any desired direction. Although very convenient, these appliances, as well as those for the adjustment of the focus, are not absolutely necessary, the fingers acquiring a great degree of dexterity by practice.

Nothing has as yet been said of the preparation of the specimen. The methods of doing this may be divided into two, according as the object is mounted *dry* or *wet;* the latter being the one almost exclusively adopted in our ordinary examinations, which are, moreover, almost always conducted by means of transmitted light. Generally a very small portion of the substance is placed on a glass slide, moistened with a drop of water, and covered with a slip of extremely thin glass. Some microscopists prefer to use, instead of water, a solution of gum, sugar, or phosphate of soda, of a specific gravity of about 1030; this is intended to prevent endosmotic changes in the tissue. When a liquid, such as blood, chyle, milk, or urine, or a mass composed of separate cells, is examined, it suffices to put on the fine glass cover, perhaps with a slight degree of pressure, to obtain a suitably thin layer for study. Fibrous textures require tearing apart with needles, and so also do the cells of certain growths, such as the epitheliomata. Bony and cartilaginous tumors, and also some glandular ones, are displayed to better advantage in thin sections.

Great importance should be attached, in all these researches, to the perfect cleanliness of the glass slides and covers, to the purity of the water or other liquid used, and to the freedom of the object from any foreign matters. Curious mistakes have sometimes been made from want of care in these respects; and, with a view of still further guarding against error, it is well for the observer to become acquainted with the shape and appearance of such impurities as are liable to be met with. Hairs, animal and vegetable, animalcules, air-bubbles, and portions of articles taken as food, are perhaps the most common of these.

Less fatigue is caused to the eye by the use of a microscope which can be inclined somewhat, than by one which is fixed in the vertical position; and it is important, for the same reason, that the habit should be acquired of so concentrating the attention upon the field of the instrument that the unemployed eye need not be closed; in this way much straining of both organs is avoided. Any one who uses the instrument frequently, will find it to his advantage also to employ the same powers as much as possible; thus enabling himself to estimate more accurately the comparative sizes of the elements brought under his notice, without the trouble of a calculation except where great exactitude seems called for. The best powers for habitual use may be chosen between 300 and 450 diameters; higher ones than these are very seldom necessary.

Certain chemical reagents are often applied to objects under the microscope, their effects in many cases affording valuable information as to structure and composition. *Iodine*, dissolved in water by means of iodide of potassium, turns starch blue. *Nitric acid* gives a marked yellow color to animal textures generally; either this or *hydrochloric* acid, diluted, or a combination of the two, will remove the calcareous portion of bone or tooth. *Alcohol* renders nerve-fibres and other animal

tissues more opaque, and therefore more evident. *Ether* removes fatty matters, except when they are enveloped in an albuminous covering. *Potassa* and *soda*, in solution, have each of them a solvent effect on certain animal textures. But the reagent perhaps oftenest employed is *acetic acid*, which brings out, in a remarkable manner, the nuclei so commonly possessed by organic cells, by rendering the cell wall transparent.

When a specimen of any kind cannot be at once subjected to microscopical examination, it should be kept in pure water, slightly alcoholized and frequently renewed; in this way its characters will not be changed, as they would be either by the action of strong alcohol or by decomposition.

Let us now inquire in what branches of surgical science the investigation by the microscope of morbid changes, deposits, and processes can be made practically useful. We may, in the first place, exclude prognosis and treatment, which can only be indirectly influenced by this mode of study. Etiology is likewise to be thrown out, for reasons which can be readily illustrated by an instance. Thus, the itch insect cannot be assumed to be the cause of the disease, in cases in which it is found, for we cannot prove that its presence is not a mere epiphenomenon. Pathology and diagnosis are the departments most indebted to the microscope for their advancement. They are of course very closely related to one another, and of great practical importance; and as we are at present especially concerned with them in this combined aspect, we have nothing to say in regard to inflammation, nor to the repair of injuries, however deserving of attention these subjects may be in their appropriate place.

The use of the microscope affords much light in regard to *material* pathology; it shows us the changes in texture, and the adventitious deposits, which accompany or constitute disease. Hence it is at once evident that, great as its value may be as an auxiliary, it cannot possibly set aside other modes of observation; the results of clinical experience must in every case be as carefully weighed as if we had nothing else to depend upon; otherwise we shall not only fall into grave errors, but depreciate the scope and dignity of surgical science. Nor can it be denied that there are some questions which are entirely beyond the range even of the assisted eye; let any one, for instance, examine under the microscope portions of pus from a chancre, from a urethra affected either with gonorrhœa or with simple inflammation, and from a common boil; that there exist certain essential peculiarities in each of these no one will deny, but to detect those peculiarities by this means no one need attempt.

The great question in microscopy discussed at present by all pathologists is, whether there is any distinctive and characteristic element in the so-called *malignant* deposits, by which they may be at once recognized. At one time the caudate cell was thought to constitute evidence of malignancy; at another, the large nucleus; at another, the double or the vesicular nucleolus; again, the multiplicity of cell forms; and finally, the existence of malignant tumors, as a class possessing distinct form-elements, has been practically, if not expressly, denied.

An attempt is even now being made, by certain German pathologists, to show that cancer and tubercle—the latter of which is, in fact, as properly malignant as any other growth—are merely abortive attempts at cells of a healthy character; tubercle cells being considered as nuclei merely. Any discussion of this view would be out of place here, and mention is made of it simply in order to show that opinions are still at variance in regard to the true theory of morbid growths. It is certain that many tumors recur again and again after removal, which do not present the microscopical appearances of cancer as described by most authors. It is no less certain that some tumors which do present such appearances have been successfully excised; at least the subjects of them have died without any fresh evidence of malignant disease.

Nevertheless, it is by no means certain that there is not a distinct and specific cancer cell; but this cell must present different forms in different cases, or even in the same case.

Caudate cells do not signify a malignant character in the growth containing them. All tissues of new formation are apt to have them in greater or less proportion; some tumors are composed of them entirely. Connective or areolar tissue, and old cicatrices, always contain them.

Nor can any form of nucleus or nucleolus, nor any number of nuclei or nucleoli, be assigned as indicative of malignancy. Pus cells generally possess two or three nuclei; fibro-plastic or fibre-forming cells often show two or more nucleoli.

On the other hand, there are assuredly circumstances under which the testimony afforded by microscopic examination is by no means unimportant, and is confirmed by subsequent events. For instance, an isolated tumor, apparently composed of areolar tissue, involved the submaxillary gland of a patient; upon its removal it was examined beneath the microscope, and found to contain cells of various shapes and sizes, some very much elongated, and all with large nucleolated nuclei; it was pronounced malignant, and reappeared within three weeks. Again, a case occurred in which the diagnosis was somewhat doubtful between cancer and menorrhagia; the former idea was shown to be correct, by the discovery in the discharge, under the microscope, of cells of extremely various sizes, caudate, elongated, and round, with large single or double nuclei; some of the cells contained also young cells. Such elements, observed in the discharge from a diseased bladder or rectum, would constitute evidence of malignant deposit in the organ.

There are cases, moreover, in which a knowledge of the microscopic structure of a tumor may enable us to allay the most painful apprehensions on the part of the patient; thus, a growth occurring in the female breast may be shown to consist simply of a hypertrophied portion of the gland, and therefore to be destitute of any malignant character.

In order to draw any positive inference from miscroscopic observations, the growths or tissues examined should be carefully scrutinized, and in many instances several different portions of them subjected to separate study. Thus, a hypertrophied lobe of the mammary gland may perhaps contain a deposit of a decidedly malignant character, and this fact may entirely escape notice in a partial or hasty examination; so also bony and cartilaginous deposits are apt, when found in con-

nection with the soft tissues—such, for instance, as the testicle—to be associated with less innocent formations.

Another no less important precaution, for the credit of microscopy, should not be forgotten. We may assert of a particular tumor that it presents no sign of malignancy; but we cannot therefore declare that the individual from whom it has been removed is exempt from cancer. He may be already the subject of a carcinomatous diathesis, which will reveal itself at some future time, perhaps at the very same point, rendered more vulnerable by the substitution of cicatricial for normal tissue. Coincidences of this kind have undoubtedly been adduced as proof of the insufficiency of the information afforded by the microscope.

The best guide, in the present state of our knowledge upon this subject, is experience; the beginner will often find himself entirely at a loss, and unable to make up his own mind in regard to particular cases. No argument is necessary to set forth the imprudence of a rash decision under such circumstances; both diagnosis and prognosis should be withheld until further observations can be made.

It is by no means uncommon for the surgeon to be in doubt as to the character of discharges taking place from some of the outlets of the body; and in clearing up these points the microscope may render essential service.

The *saliva* will often be found to contain altered epithelial scales, and various parasitic sporules and filaments, indicating derangement of the mucous membrane of the mouth.

The *sputa* may be examined with benefit in some cases of doubtful pulmonary disease; the presence of the peculiar corpuscles of tubercle, or of fibres from the parenchyma of the lung, indicates phthisis; while that of cancer cells would denote cancer of the lung. Care is necessary in these cases to avoid mistaking the free nuclei of cancer for tubercle corpuscles; an error which may have been committed by those who have asserted the coexistence of the two forms of disease in the same subject. Parasitic plants are sometimes found in the sputa, especially in cases of tuberculous disease; they are probably accidental only. Occasionally an opening is formed in the diaphragm, through which parasitic animal growths find their way from the liver into the air-passages; thus, the hooklets of the *echinococcus* have been expelled by coughing. Fibrinous casts of the smaller bronchial tubes are often met with in pneumonial sputa. All these substances must be distinguished, not only from one another, but also from particles of foreign matter, such as food adhering to the teeth, which may seriously mislead the observer.

Vomited matters present some interest. They consist usually of undigested food, with portions of epithelium; but in some diseases they contain also special ingredients. Blood, pus, cancer cells, and sarcinæ are the chief of these.

The examination of the *urine* microscopically is elsewhere discussed; that of *fecal matter* has some importance in cases of supposed cancerous disease of the rectum, in cholera, melæna, and some other morbid states. This subject has received too little attention, especially when its physiological bearing is taken into account. Here, also, care is requisite,

lest particles of undigested food, parasitic growths, or other substances, should give rise to serious errors in theory or in diagnosis.

Uterine and vaginal discharges have been before alluded to; their microscopic study is chiefly important in the diagnosis of cancer, tubercle, and other morbid deposits.

Milk is sometimes to be judged of by its microscopic characters; its colostral characters—the compound granular bodies and the variability in the size of its oily particles—should disappear by the fifth or sixth day after parturition. In order to compare specimens of milk, it is evident that the drops examined should be of the same bulk, and the thin glass cover made to press equally, in each case.

Blood, examined under the microscope, is sometimes found to contain an abnormally large proportion of white corpuscles; a condition known under the name of leucocythemia. It must be acknowledged that we have as yet by no means appreciated the importance of the changes undergone by the blood in disease.

It is occasionally of great practical moment to determine whether certain fluids or secretions, as mucus, urine, milk, or semen, furnished by an organ laboring under disease, contain *pus*, inasmuch as the presence or absence of this fluid may not only throw great light upon the diagnosis of the case, but lead to important therapeutic indications; perhaps the avoidance of a serious operation, as, for example, the amputation of a limb in the case of granular degeneration of the kidney. The most satisfactory test, undoubtedly, of all is the globular character of the pus, as revealed by the microscope, perfectly healthy mucus having no such bodies. It is only when mucus is derived from an irritated or inflamed surface that it presents corpuscles, which may then consist either of undeveloped epithelial cells, lymph corpuscles, or pus globules. Pus and pus-liquor are highly albuminous, and therefore readily coagulable by heat, alcohol, and acids; healthy mucus, on the contrary, contains no pus-liquor, and is therefore not coagulable. If the suspected secretion be agitated with a solution of potassa, it will, if purulent, be converted into a dense, gelatinous mass, but not if it consist of mucus. Mucus, treated with acetic acid, coagulates into a thin, membranous pellicle; pus does not. Subjected to the contact of ether, mucus yields no traces of fat, whereas this substance may always be extracted in considerable quantity from pus, especially if at all pure. Finally, mucus floats in water; pus, on the contrary, sinks in it.

Further observations on the distinction between pus and other fluids will appear in the chapter on the urinary organs, so as to render, for the present, any other remarks here unnecessary.

The surgeon is not unfrequently called upon for *medico-legal* information; and here the microscope may be of essential service, as, for instance, in the detection of blood-stains, or of spermatozoids in and about the vagina in cases of alleged rape. Facts of great importance have in this manner been established.

All microscopic examinations should be recorded, and drawings made of any notable appearances observed; in this way alone can permanent additions be made to the fund of knowledge possessed by the individual or by the profession at large.

CHAPTER XIII.

MINOR SURGERY.

MINOR surgery comprises an account of some of the more common instruments used in surgery, of the mode of making incisions, or of performing the elementary operations, the establishment of issues, the introduction of the seton, the application of the actual cautery, bleeding, and the art of bandaging and of dressing. As some of these topics have already been incidentally discussed, especially in the chapter on inflammation, I shall here confine myself to the consideration of those that have not yet been touched upon in previous parts of the work.

SECT. I.—INSTRUMENTS.

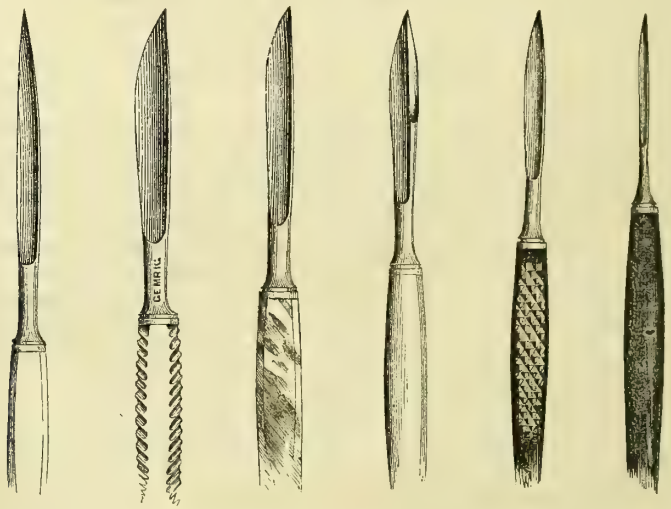
Instruments are as necessary to the surgeon in the execution of his operations as they are to the mechanic in the performance of his daily labor. But as the best workman employs the fewest tools, so the best operator employs the fewest instruments; and to the man of science and taste nothing is more disgusting than an ostentatious display of such material. A few articles, well selected, and kept in proper order, ready to do their work at the shortest notice, are all that any surgeon really requires for the successful performance of nearly every operation that he may be called upon to undertake. The simplicity of his armamentary often affords a better idea of his skill and science than the most daring feat upon the operating table.

The elementary and really important instruments are very few in number; they are the scalpel, needle, saw, forceps, probe, and director, which are the parents of nearly all the numerous and diversified contrivances found in the shops of the modern cutler. With a little modification the scalpel is converted into the bistoury, the lancet, and the amputating knife, and may be thus made to answer all the purposes required of a cutting instrument. The same needle with which a suture is made may, with a little difference of size and shape, be readily used for couching and lacerating a cataract, or inserting a seton. The saw may be modified without limit, and the same is true of the forceps, whether intended for dissection, dressing, or the division of bone. The probe, which, from its great usefulness, may almost be regarded as another finger, varies in size and shape, from the little delicate, almost thread-like instrument devised by Anel for examining the lachrymal canal to the sound employed by the lithotomist for exploring the condition of the bladder. The grooved director, which serves to guide the knife in the division of the soft parts, as in operations for

hernia, impermeable stricture, and stone in the bladder, is, in fact, nothing but a modification of the ordinary probe.

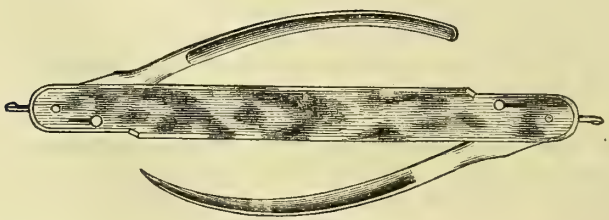
The *knives* generally in use among surgeons for the more ordinary daily operations are the scalpel and bistoury, of various sizes and shapes, so as to adapt them to the exigencies of each particular case. All such instruments should have a tolerably large handle, and I decidedly prefer one that is somewhat rough, as being less likely to slip from the fingers when it becomes wet with blood. The blade should be rather long and slender, gradually tapering to a point, which should be quite sharp, or, at any rate, not at all rounded. In some operations, a double-edged, spear-shaped knife is found serviceable, as in the extirpation of tumors, and the extraction of the cataract. Finally, it is sometimes advantageous to have a knife whose handle terminates in a semi-sharp steel edge. Such an addition is occasionally of great service in the extirpation of tumors. The annexed figures afford a good idea of the more common forms of scalpels.

Fig. 78. Fig. 79. Fig. 80. Fig. 81. Fig. 82. Fig. 83.



The *bistoury* differs from an ordinary scalpel chiefly in being longer and more slender; it may be straight or curved, with a sharp or blunt extremity. It is often made so as to open and shut like a penknife (fig. 84); but the best instrument of the kind is one with a fixed handle.

Fig. 84.



The term bistoury has been supposed to be derived from Pistori, the name of a town where it was at one time extensively manufactured. Particular forms of this instrument, invented for particular operations, will be alluded to in different parts of the work.

The adjoining sketches afford good illustrations of the ordinary forms of the bistoury; fig. 85 represents the sharp-pointed instrument, and fig. 86 the probe-pointed.

Fig. 85.

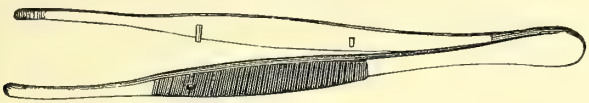


Fig. 86.



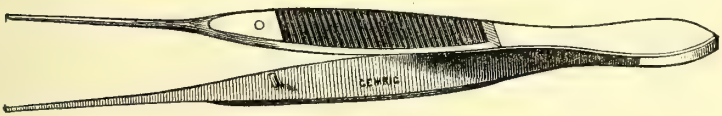
There are hardly any operations in which it is not necessary for the surgeon to avail himself of the use of *forceps*. The instrument usually employed is the common dissecting-forceps, represented in the adjoining cut (fig. 87). In some cases, as where the object is to pinch up a

Fig. 87.



delicate structure, as the conjunctiva, or a very thin layer of fascia, a pair of forceps (fig. 88) provided with a small side-prong, pointing inwards, will be found very convenient.

Fig. 88.



Scissors are nothing but two knives united by a screw, and furnished each with a ring-handle; if thin, and properly sharpened, they divide the tissues with little or no contusion, and may be employed for a great variety of purposes. They are particularly valuable in many of the more delicate operations upon the eye. They may be straight or curved on the edge or on the flat; pointed or blunt at the extremity, or one blade may be sharp and the other blunt. The annexed drawings exhibit the two principal forms of scissors used by the surgeon.

Fig. 89.

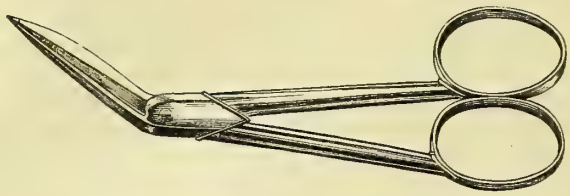
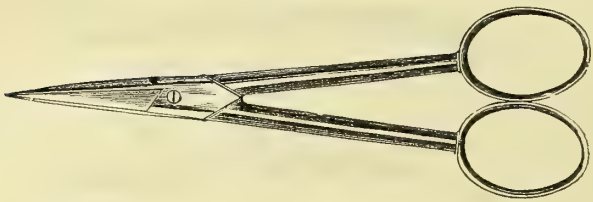


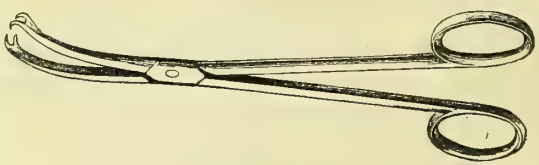
Fig. 90.



For holding the flaps out of the way in performing certain operations, especially such as involve the removal of morbid growths, among the more deep-seated structures, or the exposure of arteries, instruments, called retractors, are often of great service, and should find a place in every well arranged operating case.

For holding and pulling out morbid growths, such as deep-seated tumors of the neck or thigh, and for drawing down the cervix of the uterus in operating for vesico-vaginal fistule, as well as for other purposes, a Musseux's forceps (fig. 91), or a common vulsellum, is often of

Fig. 91.



great use. The teeth being plunged into the morbid mass, the instrument is either held by the surgeon himself, or the requisite traction is exerted by an assistant. Fig. 92 represents another contrivance, which

Fig. 92.



may be used for a similar purpose, its prongs being firmly screwed into the substance of the morbid growth.

The grooved *director*, sketched in the adjoining wood-cut (fig. 93), is

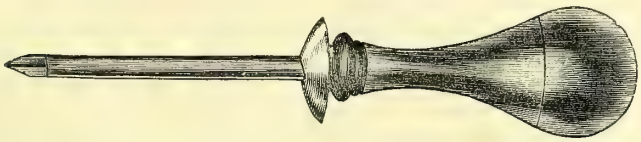
Fig. 93.



of great service in laying open sinuses and fistules, in exposing arteries, and in dividing the coverings of herniæ, and of deep seated tumors. It is generally blunt at the extremity, but in some cases it is found more convenient to have it somewhat sharp, so as to effect more easy penetration of the tissues.

The *trocar* (fig. 94), so called from the circumstance of having a

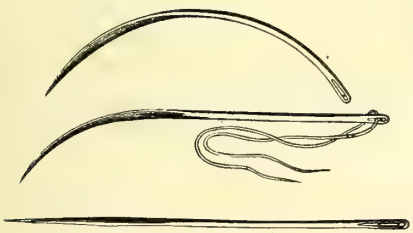
Fig. 94.



three-edged extremity, consists of a cylindrical rod, passed through a silver canula. It is employed for drawing off various kinds of fluids, as serum and pus. Its use, at the present day, is chiefly confined to the removal of water from the chest, abdomen, and vaginal tunic of the testicle. There is an instrument of this kind with a flat, spear-shaped extremity, but it is not much employed, its canula being more liable to obstruction than that of the round trocar.

There are few instruments which the surgeon has occasion to use more frequently than *needles;* they may be straight or curved, round or flat, and should be of various sizes (fig. 95). In some in-

Fig. 95.



stances, as when we are obliged to take a deep stitch, sew up a fissure of the palate, penetrate an unusually hard structure, or encircle a deep-seated artery, it is convenient to secure it to a handle, as in fig. 96.

Fig. 96.



Suture needle; with improved point, *a*. *b*. Needle in fixed handle; useful in tying erectile and other tumors.

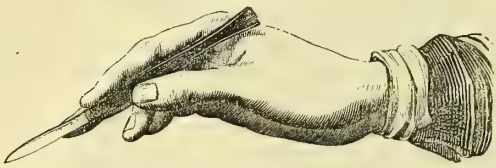
SECT. II.—INCISIONS.

It is not my intention to enter into any minute details respecting the manner of holding the knife, in operating upon the living subject, as this is a kind of information which should be acquired in the dissecting-room, in connection with

the study of surgical anatomy. A few rules, concisely and plainly stated, will be quite sufficient for the purpose, and will enable any man of sense to execute, with facility, neatness, and dispatch, any operation he may be called upon to undertake. Anything like a flourish for the sake of display, or the hope of attracting the applause of the vulgar, is as repugnant to good taste as it is out of place upon such an occasion.

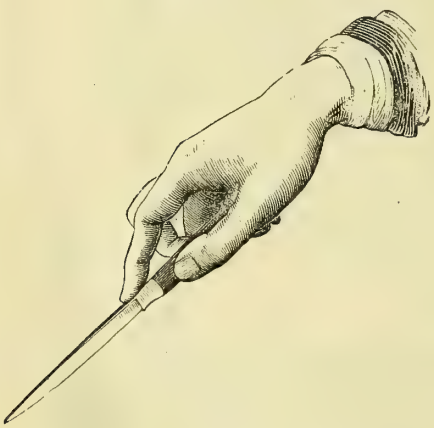
There are four principal positions in which the knife may be held for operative purposes, and with these every surgeon should make himself familiar. The annexed sketches will serve to convey a better idea of their character than any description, however elaborate. They are generally distinguished by the prefix of first, second, third, and fourth.

Fig. 97.



In the *first position* (fig. 97) the knife is held like a writing-pen, between the thumb and the first two fingers, which grasp the instrument gently yet firmly at the junction of the handle with the blade, the edge being inclined downwards or upwards, according to the intentions of the surgeon. This position is a very common one, as it is employed in a great variety of operations, as lithotomy, the extirpation of tumors, herniotomy, and the extraction of the cataract.

Fig. 98.



In the *second position* (fig. 98) the handle of the instrument lies in the palm, the thumb and middle finger holding it at its anterior extremity, while the index finger is slightly extended along the back of the blade, the ring and little fingers assisting in supporting and steadying the handle. The edge of the blade is inclined downwards or upwards, according to circumstances.

In the *third position* (fig. 99) the knife is held like the bow of a violin; that is, the instrument, turned away from the palm, is lightly balanced in the hand, the four fingers being applied against one side, and the thumb against the other. In the dissection, the blade is usually held

Fig. 99.



somewhat sidewise, and the operation is performed chiefly by alternately flexing and extending the wrist.

In the *fourth position* (fig. 100) the knife is held like an ordinary carving-knife, the handle, which inclines towards the ulnar margin of the wrist, being firmly grasped by, and almost completely concealed in, the hand, the tips of the last three fingers nearly touching the hypothenar eminence. This position is chiefly used in the amputation of the larger limbs, and, occasionally, in the extirpation of huge superficial tumors, when the surgeon wishes to produce a rapid and brilliant effect.

Fig. 100.



The *incisions* employed in operative surgery may be conveniently reduced to three principal ones, namely, the straight, curvilinear, and angular, which are the parents of all the rest. In executing these incisions certain rules should be observed, of which the most important are the following:—

1st. The knife, whether it be a bistoury or scalpel, should be in as complete a condition as possible, being perfectly sharp and clean, and as light as may be consistent with the necessary strength; its size should also be carefully adapted to the occasion.

2d. Before commencing the incisions, care should be taken to stretch, extend, or tighten the skin, which is done either by the operator alone, or partly by him and partly by his assistants. Attention to this rule is of great importance in numerous operations, as it not only expedites the movements of the knife and imparts precision to the incisions, but, what is often a matter of the greatest consequence, enables us to save integument, as, for instance, in case of amputation.

3d. The incisions, whatever be their shape, should be sufficiently large to answer the purpose for which they are designed, being made so, if possible, before the dissection is begun, as this generally greatly facilitates the removal of the parts, or their separation from each other. The principal exception to this rule is where the operation involves the division of large vessels, which, if they were all wounded at once, might be productive of serious hemorrhage.

4th. The superficial incisions should be of equal depth throughout, the knife being entered perpendicularly at one extremity, and brought out similarly at the other, the object being to avoid the formation of what is called a tail, or a partial division of the integuments at each end, as will inevitably happen when the point of the instrument is introduced obliquely. A gentle but steady sawing motion of the knife should be employed rather than firm pressure.

5th. In dividing the common integuments, the knife should always, if possible, be carried parallel to the axis of the part to be exposed or removed, in order that there may be no interference with any important vessels or nerves, which usually run in that direction. Another great point to be gained, in observing this precaution, is that we pre-

vent the flaps from bagging, and so serving as receptacles for the lodgement of blood and inflammatory deposits.

6th. The incisions should be made as rapidly as possible, seeing that the division of the common integuments is generally the most painful part of an operation. Moreover, while they should be sufficiently extensive for the object in view, care should be taken not to make them larger than is necessary.

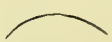
7th. All cutaneous incisions should be made with special reference to the prevention of unseemly scars. To do this successfully is not always either easy or even practicable. As a general rule, the object is best attained by carrying the knife in the direction of the muscular fibres of the part, or in the line of its wrinkles. Thus, in operating on the forehead, the surgeon will best attain his wishes if he makes his incision horizontal, not oblique, much less perpendicular. In operating upon the lower jaw, or in extirpating tumors from this region, the incisions should be so directed as to run along the base of the bone which will thus offer the best chance of concealing the resulting cicatrice.

8th. The operator, in the exercise of his functions, must be careful not to wound himself, his assistants, or his patient; an occurrence as awkward as improper, and one that will seldom happen if everything is properly arranged beforehand.

The straight incision may be made either from without inwards, or from within outwards. The former method is usually adopted in the ordinary operations, as in the extirpation of tumors, in opening abscesses, and in the ligation of arteries. Where great caution, however, is required, as in operating for strangulated hernia, or in the removal of morbid growths in front of the neck, the incision must be made from within outwards. For this purpose a fold of integument being pinched up, is held by the surgeon and his assistant, while its base is transfixed by the knife, and divided by making the instrument cut its way out. The dissection is afterwards to be conducted upon a grooved director.

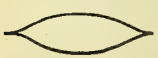
Occasionally, as in operating about the neck, especially when the object is the removal of a large tumor at the angle of the jaw, the incision may advantageously be made in a curvilinear direction, either like an Italian *f*, or in the form of a semi-ellipsis. (Fig. 101.) The chief reason for this procedure is that, while it affords the operator more room, it leaves a more seemly cicatrice.

Fig. 101.



The elliptical incision consists of two curvilinear cuts, meeting at their extremities, as is seen in the annexed drawing (fig. 102). It is chiefly employed in the extirpation of tumors, where the object is to remove along with the diseased mass a portion of redundant or unhealthy integument. The incisions are made rapidly, in the usual manner, one after the other, the skin being properly stretched, and care taken not to cut away more than is absolutely necessary, since it will otherwise be difficult, if not impossible, to bring the edges of the wound together, after the operation is over, so as to

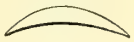
Fig. 102.



obtain a good and rapid union. Not a little judgment is frequently required to determine, in a given case, how much integument may conveniently be preserved or removed; the surgeon, remembering how contractile the skin is, will generally be cautious how he sacrifices it. Even if the flap be unseemly immediately after the operation, a few days will generally suffice to reduce it to a proper shape and size.

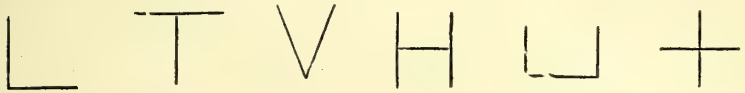
Two semi-elliptical, crescentic, or semi-lunar incisions (fig. 103) may sometimes be advantageously made, also with the object of removing a portion of integument, as, for instance, in extirpating a diseased mammary gland. The incisions may be directed vertically, obliquely, or horizontally, as may seem most suitable.

Fig. 103.



The angular incision may be used for various purposes, as in the extirpation of tumors, herniotomy, excision of joints, the exposure of diseased bone, and in the transplantation of flaps for the restoration of lost or mutilated parts. It may be made in different ways, but commonly so as to represent the shape of some letter, as in the subjoined figures, according to the exigencies of the particular case.

Fig. 104. Fig. 105. Fig. 106. Fig. 107. Fig. 108. Fig. 109.



In dissecting up the flaps, made by these different incisions, the instrument should, as a general rule, be kept in close contact with the parts to be removed; the knife should be swept along as rapidly as may be consistent with safety; good use may generally be made of the fingers, which will in most cases be found altogether preferable to the forceps. Special regard should always be had to the prevention of hemorrhage. If well-trained, intelligent assistants be at hand, there will, in general, be no necessity for tying every little artery as soon as it is divided; the instant it springs, a finger is clapped upon it, and thus the operation proceeds to its completion, when, satisfactory clearance being effected, the ligation is at once promptly entered upon, and continued until every bleeding vessel is properly secured.

When the dissection involves the exposure of an important structure, as a large artery, a strangulated hernia, or an encysted tumor, which it is desirable not to pierce, the tissues must be divided layer by layer upon a grooved director, gently and cautiously insinuated beneath them; or they may be pinched up with a pair of forceps, although this is both less elegant and less safe than the other method. In performing this part of the operation, the successive divisions must be effected in the line of the external incisions, the best knife for the purpose being a narrow, probe-pointed bistoury.

SECT. III.—AVULSION, ENUCLEATION, LIGATION, AND CRUSHING.

1. *Avulsion.*—Instead of cutting away morbid growths with the knife or bistoury, recourse is sometimes had to avulsion, or to twisting and tearing. It is in this way that the surgeon usually removes polyps from the nose and uterus, the instrument which is employed for the purpose being a suitable pair of forceps, with which the tumor is seized, and broken off, by rotating the instrument gently yet firmly upon its axis. All active, or sudden and forcible pulling is avoided, as tending to inflict serious mischief upon the parts by lacerating and injuring them to an undue extent around; or, as in the case of the nose, perhaps dragging away the turbinated bone, or, as in that of the uterus, inverting that organ, or pulling it down beyond the vulva. Moreover, by avoiding this procedure there will always, as a general rule, be much less risk of copious hemorrhage, severe pain, and shock to the nervous system.

Avulsion is sometimes advantageously practised in the extirpation of tumors developed in and among the tissues, especially when they are deeply situated, or when they lie in the immediate vicinity of large vessels, which it would be hazardous to approach with the edge or extremity of the knife. Under such circumstances, the finger may occasionally advantageously take the place of the cutting instrument, the connecting structures being forcibly lacerated, and the mass twisted and lifted out of its bed. This mode of procedure is often resorted to in the removal of tumors from the neck and parotid region, dipping deeply down behind the base and angle of the jaw, in close proximity with the pharynx and the large cervical vessels and nerves, where a false movement with the scalpel might be instantly fatal. It is astonishing what little bleeding frequently follows operations thus performed, and how well the parts generally heal after such rude manipulations. One reason why there is usually so little hemorrhage is that the vessels are torn instead of being evenly divided, as they are in the ordinary procedure.

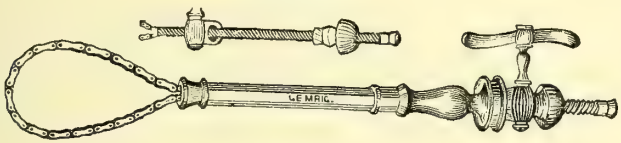
2. *Enucleation.*—Enucleation is another species of avulsion, and is often advantageously employed in the extirpation of fatty, fibrous, and fibro-plastic tumors. The integuments having been thoroughly divided over the morbid growth, along with its capsule, if there be one, the diseased structures are rapidly peeled out either with the finger, or with the handle of the scalpel. In certain cystic tumors the bag with its contents may often be peeled off bodily; or, its cavity being laid freely open, and its contents evacuated, the walls of the cyst are pulled away with the forceps.

3. *Ligation.*—There are certain operations in which the removal of the diseased parts is effected chiefly through the agency of the ligature. Of this mode of procedure familiar examples are afforded in the removal of hemorrhoidal tumors, polypous growths of the nose, vagina, uterus, and anus, and in nevous formations about the face, forehead, and other regions of the body. The ligature may be applied either directly to the part by the fingers, or by means of a needle, and should

be drawn with sufficient firmness to strangulate the included structures, as the object is to cut off the supply of blood, and cause an eschar. Occasionally the ligature is used subcutaneously, as in the case of nevous growths, involving often very interesting and complicated operations.

4. *Crushing.*—Parts, again, may occasionally be removed by a process of crushing, as proposed a few years ago by Mons. Chassaignac, of Paris, the instrument which he has invented for that purpose being what he calls the *écraseur*, or crusher; hoping thus to meet certain contingencies in operative surgery which he, in common with others, had frequently encountered in practice, and which he supposed could not be overcome in any other manner. His chief object was to supply a substitute for the ligature in the removal of certain tumors, as hemorrhoids, and polyps of the vagina and uterus. The idea seems to have been to contrive an instrument that should combine the security of the ligature with the rapidity of the knife, thus preventing hemorrhage and pain, and promptly ridding the part of abnormal structure. The écraseur, as might be supposed, was originally rude and clumsy, but, by the ingenuity of surgeons and cutlers, has been rendered very graceful and convenient, if not absolutely perfect. The annexed sketch (Fig. 110) affords an excellent representation of the

Fig. 110.



Ecraseur.

shape and construction of the instrument, as manufactured by Gemrig, Kolbé, and others of this city. It will be perceived that it essentially consists of two pieces, a sheath, barrel, or tube, either flattened or cylindrical, and of an articulated chain, attached to a steel rod, lying within the sheath, and moved by a handle. The chain is constructed upon the same principles as in the ordinary chain saw, but the links are stronger, and perfectly obtuse, except when it is desired to combine division with crushing, in which event their edges are somewhat beveled. The instrument is made of various sizes and shapes, so as to adapt it the more readily to the various cases presented in practice. The chain, unless constructed with great care, is very liable to break, especially if used for the removal of dense, indurated structures, the division of which requires a good deal of force.

The application of the écraseur has recently been very much extended, and it is quite impossible to foresee where, in the hands of its admirers, it may ultimately cease. During the last twelve months the journals have been filled with accounts of all kinds of wonderful achievements of this instrument, even including amputation of the arm and thigh by its inventor; while its more moderate and less enthusiastic partisans are content with restricting its use to the re-

moval of various kinds of tumors, especially hemorrhoidal, nevous, and ovarian, and the tongue, penis, prepuce, and neck of the uterus. The advantages claimed for it are, first, the rapidity of the operation, which is greater than that with the ligature, although less than with the knife, the instrument acting more powerfully upon the tissues embraced in its loop; secondly, the prevention of shock, the chain doing its work gradually and almost imperceptibly, so as hardly to afford the system an opportunity of taking cognizance of what is going on; thirdly, the protection of the part against hemorrhage, the vessels being placed in a condition similar to those in a lacerated and contused wound; and, lastly, the making of a smaller and less exposed wound than either the ligature or knife, and, consequently, less inflammation and a more rapid cicatrization.

The principal rules to be observed in the application of the écraseur are the following: In the first place, if the tumor has a broad base, it should, if possible, be pediculized, by drawing it away from its points of attachment, and casting a ligature around it, its base having been previously transfixed by one or two stout needles. When the coverings of the morbid growth are unusually hard, or insensibly lost in the surrounding parts, a gutter may be formed in them with the knife preliminary to the application of the chain. Secondly, the division of the tissues is to be effected slowly and gradually, not rapidly, or by fits and starts, and for this purpose the handle of the écraseur should be turned only about once every ten, twenty, twenty-five or thirty seconds. The time occupied by the entire operation must of course vary according to circumstances, from five minutes, as the average minimum, to twenty minutes, as the average maximum. The great objection to a rapid operation is the danger of hemorrhage. Thirdly and lastly, the patient, during the whole procedure, should be under the influence of an anæsthetic, otherwise the pain will be extreme, especially in the earlier stages.

The subsequent treatment is very simple. If pain arise when the patient awakes from the effects of the anæsthetic a full anodyne is given; the part is kept at rest in an elevated position, under the influence of water-dressing; and any constitutional symptoms that may show themselves are met as they occur, just as after any other operation. The wound generally heals in a very short time, with very little appearance of inflammation. I am not aware that the application of the écraseur has ever been followed, in cases at all adapted to its use, by pyemia, or any grave constitutional effects, and this is certainly one of the strongest arguments that can be urged in favor of its employment.

The écraseur is one of those novelties whose use is always, at first, followed by great abuses, which time alone can rectify. The indiscriminate employment which characterizes it at the present moment is only calculated to bring it into disgrace, by arraying against it the prejudices of the more calm and enlightened members of the profession. When it shall assume its legitimate rank, which it must do before long, it will cease to be applied to the amputation of the limbs and of the mammary gland, if not also of the penis and testicle, and will be restricted, in great measure, if not entirely, to the removal of

the tongue, the neck of the uterus, and to hemorrhoidal, erectile, and polypous tumors of the vagina and uterus; but even in these affections it will not always supersede the use of the ligature. In internal piles, for instance, I should certainly myself prefer the ligature, and in polypous growths the most eligible operation will generally be avulsion.

SECT. IV.—ABSTRACTION OF BLOOD.

Abstraction of blood may be effected by scarification, puncture, incision, leeching, and cupping. The fluid is sometimes taken from a vein or an artery; the operation, in the former case, constituting venesection, and in the latter arteriotomy.

1. *Scarification.*—Scarification is performed with the lancet, scalpel, or bistoury, passed lightly and rapidly over the inflamed surface, so as to divide the engorged vessels, and afford them an opportunity of freeing themselves of their contents. It is employed chiefly in conjunctivitis, tonsillitis, erysipelas, and irritable ulcers, and may be repeated once a day, or once every other day, according to the exigencies of the case, the bleeding being promoted by the liberal use of warm water. In irritable ulcers of the extremities as well as in other parts of the body, scarification is an exceedingly useful practice, which I have pursued, for many years, with great advantage. The proper mode of proceeding is to immerse the limb, previously constricted just below the knee, in a vessel of warm water, and then to make from four to eight vertical incisions over the sore, extending merely through the superficial portion of the true skin. In this manner I have repeatedly bled my patient to syncope, making thus a most salutary impression both upon the part and system. In granular conjunctivitis, the eyelids, especially the upper, may often be scarified with the happiest effect; and in ophthalmia, attended with chemosis, deep incisions are generally practised to relieve engorgement and prevent strangulation of the vessels of the cornea. In tonsillitis, scarification nearly always greatly mitigates the symptoms; and in erysipelas, especially the phlegmonous variety of that disease, it forms a most important element of the local treatment, nothing else being so well calculated to remove tension and prevent gangrene.

2. *Puncturing.*—Puncturing is performed pretty much with the same intention as scarification. It is particularly valuable in erysipelas, active œdema, boils, carbuncles, hemorrhoids, and affections of the tonsils, uvula, lymphatic glands, scrotum, prepuce, uterus, labia, and nymphæ, its beneficial effects depending upon the amount of drainage which follows the operation. The best instrument for performing the operation is a very narrow, sharp-pointed bistoury, thrust rapidly into the inflamed surface, to a depth varying from a line to half an inch, according to the degree of swelling of the affected parts, care being taken to avoid injuring important vessels and nerves. In phlegmonous erysipelas, as many as fifty, seventy-five, or even a hundred punctures may sometimes be made with advantage.

3. *Leeching.*—Leeching is applicable to a great variety of affec-

tions, and is perhaps more frequently employed than any other mode of topical bleeding. The operation, however, is not without pain, and, unless properly performed, may even be followed by danger. Thus in epidemic erysipelas, I have known it to give rise to an attack of this disease, which speedily destroyed the patient. Sometimes, again, leech-bites degenerate into bad sores, and produce a great deal of constitutional irritation. Ill effects will be most likely to arise when the leeches are sickly, and when they are applied to persons of a nervous, irritable temperament. Hence, great caution should always be exercised in their selection, as well as in the manner of using them.

The best leeches are the Swiss, German, French, and Spanish, which generally take hold with great avidity, and draw each from half an ounce to six drachms of blood, including the flow which takes place after the animal drops off. The American leech, although much larger than the European, bites reluctantly, and sucks sluggishly, on which account it is now rarely used. Experience has proved that the wound made by the foreign leech will emit four times as much blood as that made by the native; a fact which should not be lost sight of when we order this kind of local bleeding. Whatever species be employed, the rule is always to divest the part of hair and dirt, otherwise the animal will either not take hold at all, or only after much coaxing, its tastes and habits being extremely fastidious. If, notwithstanding these precautions, it does not seem inclined to bite, the best plan will be to smear a little blood upon the surface, drawn from the operator's finger, previously constricted with a tight fillet, or to wet it with a little sweetened milk. Immersion of the leech for a few minutes in small beer will sometimes induce it to take hold when hardly anything else will. When the number to be applied is considerable, they should be put in a tumbler, which is then inverted upon the part from which the blood is to be drawn, and which will also prevent them from crawling about. It is a good plan, generally speaking, not to group them too closely together, but to let them fasten themselves at some little distance from each other. Another rule is not to pull them off, but to let them detach themselves, as they will be sure to do as soon as they have "taken their fill." Their forcible separation is not only a source of pain, but it sometimes leaves a portion of the jaw in the little triangular wound made by its bite, which is sure to become inflamed and irritable in consequence. As soon as they have all dropped off, the bleeding is encouraged by sponging the surface well with warm water, and then covering it with a thickly-folded flannel cloth, wrung out of hot water, and frequently renewed, for a period varying from thirty minutes to two hours, or even longer, according to the effect it is desired to produce. The blood having ceased to flow, the part is sprinkled with a little powdered starch, and protected with a dry cloth. If there be any disposition to bleed more, or longer, than is deemed proper, it will be well to cover the bites with a piece of dry tinder, which generally soon puts a stop to the effusion.

The number of leeches to be applied varies from one to several dozens, according to the intensity of the morbid action, and the age

and strength of the patient. In the adult a good average number is from fifteen to twenty; in children, under five years of age, from three to six. In infants a single leech has sometimes been followed by fatal depression. The extraordinary delicacy of the skin, and, consequently, the great depth of the animal's bite, are reasons why leeching should be practised with more than common caution at this tender age.

There are certain localities where leeches should never be applied. Thus, in the first place, they should not be used upon the face, neck, and other parts habitually exposed, because their bites are liable to be followed by disfiguring scars, which are particularly objectionable in the female. Secondly, they should not be applied to those regions of the body which contain an extraordinary amount of loose cellular substance, as the eyelids, scrotum, prepuce, labia, and nymphæ; or along the course of large veins, superficial arteries, or nervous trunks; lest, in the first case, their bite should be followed by infiltration of blood, in the second by hemorrhage, and in the third by severe pain. Thirdly, it is a good plan not to apply any leeches to the centre of an inflamed surface, inasmuch as they might thus aggravate the morbid action, and bring on gangrene. Finally, leeches are never used upon specific ulcers, as chancres and buboes, for fear of inoculating their bites, and extending the specific disease.

A discharge of blood by leeches for a number of successive hours is sometimes very desirable, as soon as one set drop off another supplying their place. In violent ophthalmia, croup, peritonitis, dysentery, erysipelas, and buboes, there is no mode of depletion so beneficial, or so well calculated to put a prompt and permanent stop to the disease, as this.

In leeching the uterus, vagina, ano-rectal outlet, the nose, and inside of the cheek, the animals must be confined in a glass or wire speculum, the opening in the instrument being held to the part from which the blood is desired to be taken.

Serious, and indeed, frightful, hemorrhage sometimes follows a leech-bite. The occurrence is especially to be dreaded in children, in whom it occasionally produces fatal exhaustion. The best remedies are dried tinder, bound firmly upon the part, compresses wet with saturated alum water, or a solution of the persulphate of iron, and cauterization with the solid nitrate of silver, cut to a delicate point, and inserted into the little wound, previously well cleansed and dried. If these means prove abortive, the edges of the wound are transfixed with a cambric needle, and approximated by ligature; a procedure which I have never known to fail.

4. *Cupping.*—Cupping is by no means so eligible a mode of bleeding as leeching, being more painful, less elegant, and not so generally applicable. It is, nevertheless, when properly executed, a valuable operation, particularly in the early and declining stages of inflammation. An incipient pleurisy, pneumonia, or articular inflammation, is often promptly relieved by the application of half a dozen cups; but it is chiefly in the latter stages of acute disease, after the morbid action has been weakened by other remedies, and in chronic affections,

that cupping asserts its true rank as an antiphlogistic agent. It is seldom, if ever, permissible in gastritis, peritonitis and enteritis, on account of the great pain produced by the application of the scarificator. The operation, to be really serviceable, should be performed as near to the seat of the disease as practicable, care being taken not to open any large vessel, to prick any nervous trunk, or to wound any tendons. The surface selected for the application of the cups must be free from bony prominences, and, without being very soft, must have a pretty good stratum of subcutaneous cellular substance, otherwise it will be impossible for the cups to maintain their hold, and extract a sufficient amount of blood. If the part be thickly covered with hair, it must be previously shaved.

The scarificator usually employed for dividing the skin is provided with sixteen little blades, moved by a common spring, and so arranged as to make a corresponding number of incisions, none of them being deep enough to extend entirely through the cutaneous tissues, lest the fatty matter, projecting into them, should fill up the little orifices, thereby impeding the flow of blood. The cup is capable of holding from one to two ounces; it is bell-shaped, and is composed of glass, having a large mouth, with a stop-cock at the other end, to adapt it to a syringe for exhausting the air. When such an apparatus is not at hand, the ordinary cupping-glass may be used, or any still more simple contrivance, the air being rarefied by inverting the vessel over the flame of a lamp, or by means of a little pellet of cotton, wet with alcohol, and set on fire in the glass. In a few moments the skin will rise up and form a red conical swelling, which is now scarified, the cup being immediately replaced, and allowed to remain until the coagulum which fills its interior prevents the flow of blood, when it is carefully removed, to be again replaced as soon as the incisions have been freed from obstruction. Should the bleeding be inclined to stop, before the requisite supply has been obtained, the surface may now be cross cut, and the operation be proceeded with as before. As much blood having been drawn as may be considered proper, the glasses are removed, and the parts are covered with a soft cloth moistened with oil. The number of cups to be applied varies from one to a dozen, according to the effect it is designed to produce.

5. *Venesection.*—Venesection is commonly regarded as so trivial, simple, and easy an operation, that it has rarely received the consideration and attention to which its intrinsic importance really entitles it. Everybody, no matter whether he has any knowledge of the anatomy of the parts involved in the operation, or the slightest skill in the use of instruments, is supposed to be capable of performing it, and hence it is often done in the most bungling and disreputable manner, entailing much suffering, if not loss of limb and life, upon the patient, and great discredit, if not ruin, upon the practitioner. When we consider the frequency of the operation, and the character of the men who usually perform it, our only surprise is that these disasters are not more common. During a practice of upwards of a quarter of a century, in which I have often had occasion to open different veins, I have had the good fortune never to do any harm in this way, and it would afford me great plea-

sure if I could make a similar statement concerning the practice of some of my professional brethren. Candor, however, compels me to assert that I have repeatedly witnessed in their hands the most serious effects from this source. In two cases I have seen the patients perish from phlebitis; in three, I have been called upon to tie the brachial artery at the bend of the arm, on account of injury sustained from the lancet; in several, I have known vast and protracted suffering to succeed the puncture of a nerve; and in three instances I have seen the arm endangered by erysipelatous inflammation, followed by immense abscesses, and great impairment in the function of the elbow-joint, wrist, and fingers. In one of the cases, here adverted to, the operator, a young man, was sued for mal-practice, and, after much trouble and vexation, mulcted in the sum of several hundred dollars, which he was little able to pay. I need hardly add that he never recovered from the effects of his misfortune, which pursued him during the remainder of his life. It is related of Mons. Marechal, who flourished in the reign of Louis XIV., and who was styled, by one of the poets of his day, the prince of surgeons, that he greatly suffered in his reputation, for several years, on account of a fatal accident which followed the operation of bleeding which he performed upon a foreign nobleman. These circumstances should be sufficient to put practitioners upon their guard, and should induce them to study this operation in all its bearings and relations, so that they may be able to perform it with credit to themselves and advantage to their patients.

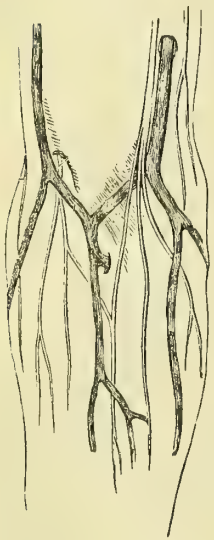
A vein may be opened with a spring lancet, a thumb lancet, or a bistoury, according to the whim, fancy, or habit of the operator. I have been so long accustomed to the use of the former of these instruments that I rarely employ any other. My experience has taught me that the operation, when done with the spring lancet, generally answers every purpose, as it respects the size and shape of the orifice, the safety of the parts, and the facility of manipulation, while it is incomparably less painful than when it is performed with the thumb lancet, or bistoury. These are, I think, important desiderata, which no unprejudiced practitioner can overlook. No one who has himself been bled with these different instruments can hesitate about his future choice. I have often heard persons, who had been previously bled only with the thumb lancet, declare, after having been bled with the spring lancet, that nothing could ever induce them again to submit to the use of the former instrument, such was the difference in regard to the pain in the two operations. I know that the thumb lancet is generally considered as a more scientific instrument than the spring lancet; it is certainly more simple, and, perhaps, also more easily kept in order; but these advantages do not, in my judgment, outweigh the disadvantages. Both these instruments are so well known that any description of them here would be superfluous. If a bistoury be used, one of very small size should be selected, somewhat like that used in opening abscesses, described at page 169. It should be quite narrow in the blade, slightly spear-shaped at the extremity, and not more than half an inch long in the cutting part. Such an instrument confined in a light handle, is more elegant than the ordinary thumb

lancet, as well as more easily managed, and is, I think, decidedly more surgical and scientific; a circumstance so much insisted upon by some practitioners.

Whatever instrument be employed, care should be taken that it is perfectly sharp and clean, that is, free from rust and other adventitious matter. It should always be washed and thoroughly wiped both before and after the operation; for it is only by observing these precautions that the instrument can be kept in proper order, and that the surgeon can hope to avoid undue irritation and other mischief in the wounded structures.

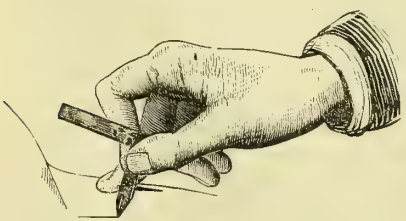
In bleeding at the bend of the arm I am always in the habit of selecting the largest and most superficial vein, having previously ascertained that the brachial artery is not in danger of being wounded, as it may be when it lies just behind the vessel, or close along its side. When the artery separates high up, one of its branches generally lies immediately below the skin, and might thus be easily opened by an incautious operator. As it respects the superficial nerves, it is seldom possible altogether to avoid them, whatever vein may be selected; nor is this a matter of much moment, provided they are completely divided, and not merely pricked. The veins of the bend of the arm, with the accompanying nerves, are well seen in the annexed cut (fig. 111).

Fig. 111.



In order to distend the veins, a fillet, a yard long by an inch in width, and consisting of a piece of muslin, is tied firmly round the arm, about two inches and a half above the bend, the ends being secured with a slip knot. Care is taken not to draw it so tightly as to interrupt the circulation in the brachial artery. The patient, extending his arm at a right angle with the trunk, in a state midway between pronation and supination, grasps a common cane, a yardstick, or any other suitable object, holding the limb in an easy, gentle position. The surgeon then, standing behind the limb, pierces the vein, making the opening obliquely, and of sufficient size to furnish a free stream. The adjoining sketch affords a better idea of the manner of holding the lancet than the most elaborate description could. The surgeon uses whichever hand may be most convenient; the vein is thoroughly steadied with the finger previously to making the incision, and care is taken that the orifices in the skin and vessel do not afterwards lose

Fig. 112.



their parallelism, lest the flow of blood should thereby be seriously embarrassed, or the fluid escape extensively into the subcutaneous cellular tissue. Should the latter accident occur, the fillet must immediately be removed, and the requisite abstraction effected from another vein. Sometimes the blood flows sluggishly, although the opening may be quite capacious and unobstructed. When this is the case, the patient should be requested alternately to flex and extend his fingers, so as to cause energetic contraction of the muscles of the forearm, which often powerfully promotes the bleeding; or, instead of this, or along with it, the operator applies friction to the limb from below upwards with his hand, although such a procedure is seldom attended with much advantage. Sometimes the flow of blood is interrupted by the protrusion of a pellet of fat into the orifice of the vein, or in consequence of the timidity of the patient, or the occurrence of partial syncope.

When the spring lancet is used, the instrument is held between the thumb and the first two fingers, the heel being raised a little from the surface, while the fleam is gently pressed upon the distended vein. The opening is effected in the same oblique manner as in bleeding with the thumb lancet.

The blood should always be received into a large basin held by an assistant, and special pains should be taken not to soil the patient's body or bedclothes. When the object is to make a strong and permanent impression, the blood is taken from a large orifice, the patient being, the while, in the semi-erect posture. If he is very plethoric, and the object is to abstract a very large quantity of blood, without occasioning syncope, the recumbent posture is selected. When the requisite amount of fluid has been discharged, the fillet is untied, and the arm is nicely wiped with a napkin wet at one end; the edges of the orifice are then carefully approximated and covered with a small, thick compress, supported by a narrow roller passed around the elbow in the form of the figure 8. The arm should then be put in a sling and kept at rest for the next forty-eight hours, as premature motion is calculated to favor the development of suppuration and erysipelas.

When blood cannot be obtained from the arm, it may sometimes, in case of urgency, be drawn from a vein on the back of the hand, from the cephalic vein as it runs along the groove between the deltoid and pectoral muscles, or from the external jugular vein. In the latter case, the requisite distension is produced by pressure with the thumb, applied just above the collar bone, or by means of a thick, narrow compress, firmly secured by a roller carried round the neck and shoulder. The requisite incision is made with a bistoury, carried from below upwards and outwards, in a direction contrary to that of the fibres of the platysma myoid muscle. Before removing the compression, care is taken to close the orifice of the vein, lest air should get into it, and thus occasion serious, if not fatal mischief.

The *accidents* which are liable to attend and follow this operation are, infiltration of blood into the subcutaneous cellular tissue, inflammation of the edges of the wound and of the surrounding parts, phle-

bitis, angeioleucitis, puncture of the nerves, and wound of the brachial artery.

a. An *extravasation* of blood beneath the skin is one of the most common effects of this operation, and may be caused by various circumstances, as the smallness of the incision, the want of parallelism between the outer and inner openings, the great laxity of the areolar tissue, transfixion of the vein, and the accidental occlusion of the wound by the interposition of adipose substance. The extravasation may be diffused, or circumscribed, forming in the one case an ecchymosis, in the other a thrombus. In the former variety, the blood sometimes extends along the anterior part of the limb, nearly as high up, on the one hand, as the axilla, and, on the other, as far down as the inferior third of the forearm; imparting, at first, a dark, purplish hue, and afterwards, as the fluid becomes absorbed, a mottled, greenish, yellowish, or sallow appearance to the skin. A thrombus is a collection of blood immediately around the wound, from the volume of a marble to that of a pullet's egg, irregularly rounded at the base, and usually somewhat pointed at the top. Both these accidents are most liable to occur in thin, emaciated subjects, in bleeding at the basilic vein, and they should always be promptly remedied by attention to the exciting cause; or, where this is impracticable, the bandage should be removed immediately, and the requisite quantity of blood be taken from another vessel. The latter procedure is particularly indicated when the infiltration is dependent upon transfixion of the vein, the presence of a pellet of fat, or unusual laxity of the areolar tissue. Defective parallelism may sometimes be corrected by changing the position of the limb; and a small orifice may be enlarged by the reintroduction of the instrument. Under no circumstances, whatever may be the nature of the difficulty, should the operator attempt to promote the flow of blood by the use of the probe, inasmuch as this would inevitably be followed by mischief.

When the extravasation is slight, it will usually disappear spontaneously in a very few days; when considerable, recourse must be had to refrigerant and sorbefacient applications, particularly a strong solution of the hydrochlorate of ammonia, alcohol and water, and, in the latter stages, to camphorated lotions, soap liniment, and stimulating unguents. If matter form, or if the parts become angry and inflamed, leeches, blisters, and cataplasms may be necessary, with incisions to evacuate the effused blood and other fluids.

b. The edges of the little wound, made in this operation, sometimes *inflame* and suppurate; or, instead of this, a small abscess, conical, circumscribed, and very painful, forms immediately around it. Occasionally, especially in feeble, sickly, and intemperate persons, the morbid action assumes an erysipelatous type. The most common causes of these mishaps are a dull, rusty, or foul lancet, imperfect apposition of the lips of the wound, improper tightness of the dressings, premature use of the parts, and, above all, the contact of the fingers, after the removal of the fillet, for the purpose of preventing the further escape of blood. The latter circumstance has not received sufficient attention. The fingers of the operator, without his being aware of the fact,

are often covered with perspiration and other matter, which, when brought in contact with the edges of the incision, are almost certain to irritate and inflame them. My invariable practice is never to touch the wound for any purpose, but, after the fillet is removed, to approximate its lips with a clean compress, made of old muslin, and confined by an appropriate bandage. If, despite proper precautions, inflammation and suppuration arise, the usual antiphlogistic means must at once be employed.

c. Phlebitis, to a slight extent, is probably of much more frequent occurrence after this operation than is generally imagined; while the severer forms of the disease are comparatively rare. It may be induced by various circumstances, of which the employment of a foul lancet is perhaps the most common. In one instance I knew it to be caused by probing the wound, under the supposition that it contained a piece of the fleam of a spring lancet, broken off in the operation, which was performed by a young and inexperienced practitioner. The patient, a man, about thirty-six years of age, was laboring under bilious fever, from which, but for this unfortunate event, he would probably have recovered; phlebitis, however, set in, and he lost his life in less than a week. In another instance, more recently under my observation, the vein was opened with a thumb lancet, and the disastrous effect seemed to have arisen without any evident cause; the patient, a stout negress, having labored at the time under inflammation of the wrist joint. Death ensued in less than ten days after the operation. In some instances, if, indeed, not frequently, the inflammation takes place without any obvious cause, and that too, perhaps, when the operation has been performed in the most unexceptionable manner.

The symptoms of this form of phlebitis do not require special notice, inasmuch as they do not differ from those of phlebitis in general. The attack is commonly ushered in by pain, stiffness and swelling of the affected part, and by rigors, alternating with flushes of heat, and followed by copious perspiration. The inflamed vein is gradually converted into a hard, rigid cord, and the morbid action steadily pursues its course towards the heart, its progress being indicated by a reddish blush of the skin. In some instances, metastatic abscesses form in different parts of the body, particularly in the subcutaneous cellular tissue round the larger joints, if not also in the joints themselves. Meanwhile, the symptoms assume a typhoid character, the mind wanders, great soreness is felt in the muscles and articulations, the patient complains of excessive prostration, and death generally follows in from six to eight days from the commencement of the invasion.

The treatment consists in the application of leeches, blisters, and iodine along the course of the vein, and the exhibition of calomel and opium, with the twofold object of bringing the system promptly under the influence of mercury, and allaying pain and promoting sleep. Abstraction of blood from the arm is rarely indicated, and is, in general, prejudicial. Active purgation and the free use of antimony must also be avoided. If abscesses form, they must be thoroughly and promptly opened. Should recovery take place, sorbefacients will be required to promote the removal of effused fluids in and around the

diseased vein, which, however, despite our treatment, usually remains impervious.

d. Angeioleucitis is usually produced by the same causes as phlebitis, which it also resembles in its nature, progress, and symptoms. The morbid action, still more than in the latter disease, has a tendency to extend up the limb, the course of the affected lymphatics being indicated by reddish lines, very narrow, and exquisitely tender on pressure. The malady, which is quite infrequent, and which rarely does much harm, requires the same treatment as phlebitis, with which it is occasionally associated.

e. Puncture of a *nerve*, whether a considerable-sized trunk, or a mere thread-like filament, may prove to be a very serious accident. The nature of the injury is always indicated by a peculiar stinging, burning, or pricking pain, and a sense of numbness, creeping, or formication in the distal portion of the limb. When very severe, the local distress may be attended with a certain degree of shock and a tendency to syncope, which, however, generally pass off in a very few minutes. Very unpleasant secondary symptoms sometimes succeed this accident, at a period varying from several weeks to several months. One of the most common and distressing of these is neuralgia, which is often attended with regular paroxysms, precisely as neuralgia is when it occurs from ordinary causes in other situations. The disease is then apt to be exceedingly severe and obstinate, often resisting for months, and even years the best directed efforts at relief. In the cases which have fallen under my observation, it has usually been accompanied, especially in its earlier stages, with considerable swelling, numbness, and stiffness in the distal portion of the limb, together with exquisite tenderness on pressure along the course of the affected nerve. I have never known tetanus to follow this accident; but such an occurrence I should think quite possible, particularly in a person of a nervous, irritable temperament, laboring, at the time of the injury, under disorder of the digestive organs.

The mild effects of this injury will usually pass off in a very short time without any remedial measures, simply by attention to rest and elevation of the limb. This failing, recourse is had to anodyne and astringent fomentations, the application of iodine and even blisters, purgatives, light diet, and other antiphlogistic means. The bandage will often be of great service, especially when there is considerable swelling. If the pain is of a neuralgic character, quinine, strychnine, and arsenious acid will be indicated, and, if given persistently, and in suitable quantities, will be of immense benefit. Where the suffering is extremely violent and intractable, the best remedy is division of the affected nerve, as near as possible to the seat of the injury, by the subcutaneous method; or, where this is impracticable, by exposing the nerve first, and then severing it. Occasionally it becomes necessary to remove a small portion of the affected nerve, especially if, as now and then happens, it is expanded into a little nodule, or is exquisitely tender and sensitive on pressure.

f. A wound of the *brachial artery* is always a very serious accident, and is probably much more frequent than is generally supposed. The

injury may be very slight, amounting to a mere puncture, or it may be several lines, half an inch, or even an inch in extent, as in a case under my observation, some years ago. The direction of the wound may be oblique, longitudinal, or transverse, according to the manner in which the instrument is held at the time of the operation. Occasionally the artery, instead of being pierced or stabbed, as it ordinarily is, is transfixed; a circumstance which always seriously complicates the case.

The immediate effect of this accident, which is always denoted by the impetuous, saltatory nature of the stream, and by its scarlet complexion, is to send the blood into the connecting cellular tissue, forming a soft, dark-colored, and circumscribed tumor, or a diffused swelling, which may involve the greater portion of the anterior surface of the limb from the middle of the forearm to within a short distance of the axilla. Such an occurrence is always formidable in its character, alarming to the patient, embarrassing to the surgeon, and liable to be followed by the worst consequences.

The treatment of this accident is by systematic compression, when the opening is small, and by ligation of each extremity of the artery, when it is large.

6. *Arteriotomy.*—This operation is occasionally necessary in urgent affections of the brain and eye, and is usually performed upon the anterior branch of the temporal artery, a vessel which possesses the twofold advantage of being very superficial, and at the same time resting upon a resisting bone. Feeling for the artery, in front of the temple, the surgeon applies firm pressure upon it with the finger, so as to steady it properly, while he makes the requisite incision with a small bistoury, carried obliquely across the vessel, care being taken to cut the parts in such a manner as to admit of a full and rapid stream. A sufficient amount of blood having flowed, the artery is completely divided, in order that its extremities may retract, and thus prevent the formation of an aneurism. A small thick compress is then placed upon the wound, and firmly secured by a bandage, carried round the head in the manner represented in the adjoining cut (fig. 113).

Fig. 113.



Compress applied to the temporal artery, after arteriotomy.

SECT. V.—COUNTER-IRRITATION.

Counter-irritation may, as stated elsewhere, be established in various ways, as by rubefacients, vesicants, and dry cupping; but when the object is to make a deep and protracted impression, the means usually selected are the permanent blister, the seton, and issue. Sometimes the moxa and acupuncturation are employed.

1. *Dry Cupping.*—Dry cupping is occasionally employed, especially

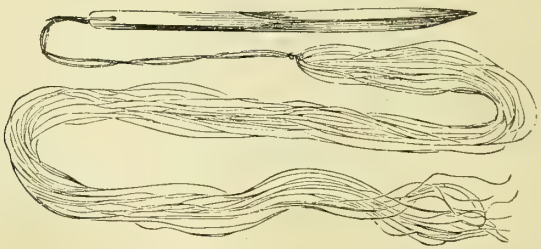
in chronic affections, in which it is often of great value. The air being exhausted, as in the more common operation, the cup is allowed to remain on the part for a period varying from thirty to forty-five minutes. At the end of this time it will generally be found that there is not only a marked afflux of blood, but likewise more or less vesication of the skin; objects which the practitioner should always endeavor to attain whenever he advises such an operation; for, unless it be performed efficiently, it might as well not be performed at all.

Dry cupping is particularly serviceable in chronic disease of the brain and spinal cord, the thoracic and abdominal viscera, and the larger joints. The number of cups employed, and the repetition of the operation, must of course be regulated by the exigencies of the particular cases.

2. *Permanent Blisters.*—A permanent blister is made by letting the fly remain on the skin an unusual length of time, and then divesting the part of epidermis. It is capable of furnishing a free discharge of pus, which may often be maintained for a long time, either by the occasional re-application of the fly, or by means of some irritating ointment, as the savin or mezereon, or, what I prefer, an ointment composed of an ounce of lard and three to eight drops of nitric acid. Whatever article be used, the surface should be constantly protected with an emollient poultice or the warm water-dressing, otherwise the sore will become excessively irritable, and cease to furnish the desired discharge. Whenever the secretion begins to slacken, a little of any of the unguents here mentioned may be applied to the sore to renew the morbid action. I have occasionally used the dilute fly ointment for this purpose, but having several times produced strangury with it, I have latterly abandoned it.

3. *Seton.*—A seton is a subcutaneous wound, holding a foreign body. It may be made with a bistoury, and a piece of gum-elastic tape, or, in the absence of this, a narrow strip of muslin, conveyed beneath the skin with an eyed probe or the seton needle, represented by the accompanying drawing (fig. 114). The integuments being pinched up,

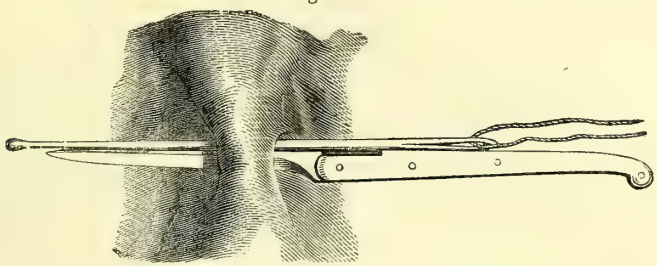
Fig. 114.



the instrument is pushed on through the cellular tissue, care being taken not to interfere with any muscular fibres, tendon, nerve, or vessel. The ends of the seton are tied long, and held out of the way by a strip of adhesive plaster. The mode of introducing a seton with the knife and probe is shown in the annexed cut (fig. 115).

An emollient cataplasm is the most suitable dressing, both immediately after the operation and subsequently, during the sojourn of the foreign body. At the end of the second day, the tape is drawn gently across the wound, a fresh portion taking its place; and this process is afterwards repeated as often as cleanliness and other circumstances may render it necessary. If the discharge becomes defi-

Fig. 115.



cient, recourse is had to some stimulating ointment; if offensive, to the chlorides. When the tape becomes soiled and unfit for use, a fresh one takes its place. Sometimes fungous granulations spring up at the orifices of the subcutaneous wound, causing much pain and inconvenience. The best remedy is excision, followed by the nitrate of silver. Very little bleeding attends this operation, but I recollect a case which occurred, many years ago, at Cincinnati where the patient, an elderly gentleman, came very near losing his life from hemorrhage caused by the introduction of a seton in the nape of the neck. The blood seemed to have proceeded from a small artery among the cervical muscles, the instrument having penetrated too deeply.

A seton is, on the whole, a filthy, painful, and imperfect form of counter-irritation, which it might, perhaps, be well to exclude altogether from practice, as its place may always be easily supplied by the issue.

4. *Issue.*—An issue is an artificial ulcer, intended to furnish a discharge of pus. It is adapted to the same class of cases as the seton, but is more cleanly, less painful, and more convenient. Moreover, such a sore affords a good surface for the local application of morphia and other remedies, which may often be advantageously used, in this way, for relieving pain, as well as for other purposes.

Issues may be made in various ways, as with the knife, the Vienna paste, and the actual cautery. The first of these methods is not sufficiently efficient to justify its general employment; it is better adapted to the scalp than to any other region of the body, and may be advantageously used in diseases of the pericranium, and of the brain and its meninges. An incision being made through the skin and cellular tissue, from half an inch to an inch in length, its cavity is filled with some foreign body, as a pea, grain of corn, small pebble, or piece of orris root, which soon produces a pyogenic action, that may afterwards be increased, if necessary, by the use of some stimulating ointment, in the same manner as in the case of the seton. The substance

is confined with a strip of adhesive plaster and a bandage, and is occasionally replaced by a fresh one, cleanliness being maintained in the usual way.

A better plan is to make the issue with the *Vienna paste*, composed of equal parts of quicklime and caustic potassa, thoroughly triturated together, and preserved in a closely corked vial until required for use. The requisite quantity is then put upon a piece of glass, or upon the bottom of a saucer, and converted into a thick paste with alcohol. A layer about two lines in thickness, and of the desired diameter, is put on the skin, and allowed to remain for eight, ten, or fifteen minutes, according as we wish to make a slight or deep impression. The surface, which will be found to be of a pale drab color, is washed with vinegar and water, to neutralize the alkali, and covered with an emollient cataplasm, to promote the detachment of the slough, which usually happens in from five to eight days. Some pain attends the operation, but this is soon over, and bears no comparison with the horrible distress produced by the application of caustic potassa alone; besides, the Vienna paste does not diffuse itself over the adjacent parts, and thus unnecessarily destroy the skin. The extent of the issue is regulated by the extent of the layer; one of the diameter of a twenty-five cent piece affording, when the sloughing is completed, a sore from three to five times that size. The best permanent dressing is a poultice; the best promoter of discharge, a stimulating ointment, or the occasional use, for a few hours, of a small blister.

The most eligible issue of all, however, is that made with the *actual cautery;* it affords not only an abundant and protracted discharge, far beyond what follows the more ordinary issue, but, what is often a matter of no little consequence, it makes an impression both upon the part and system, which no other mode of counter-irritation is capable of producing. On these accounts, this kind of issue should have a decided preference over every other, in all protracted and obstinate cases of disease, where the employment of revulsives is indicated, as in caries of the hip-joint, Pott's disease of the spine, and similar affections, in which its powers, as a topical remedy, are unequalled.

The actual cautery, when used for this purpose, is of course attended with pain, and for this reason it will generally be well to administer some anæsthetic, although the suffering is much less than is usually imagined. Formerly, before the discovery of this class of agents, I was constantly in the habit of making this kind of issue, and often had occasion to notice the little pain it produced, even in very young children and nervous persons. The manner of proceeding is to heat the cautery perfectly white, in a chafing-dish of charcoal, and then to hold it, with some degree of firmness, upon the proper spot, until the skin is converted into a dark eschar, care being taken not to penetrate beyond the subcutaneous cellular substance. A cloth, wrung out of cold water, is immediately laid upon the part, and frequently renewed, for ten or twelve hours, when it is replaced by a poultice or the warm water-dressing. The slough usually drops off in from five to ten days, leaving a sore, which, while it is easily kept clean, furnishes a free discharge, and may be maintained open, with but little care, for an

almost indefinite period. A cautery the size of a half eagle will make an issue, after the separation of the eschar, of the diameter of a silver dollar. The instrument should be fully half an inch thick, otherwise it will not retain its heat sufficiently long.

5. *Moxa.*—The moxa is a soft combustible substance held upon the skin, and suffered to burn down slowly, so as to produce a temporary irritant effect. It may be prepared from various articles, as agaric, hemp, cotton, rotten wood, the pith of the common sunflower, and the down of the artemisia chinensis; but the one which I usually prefer is soft patent lint, thoroughly soaked in a strong solution of nitrate of potassa. When thoroughly dried, this is rolled up into tolerably firm cylindrical cones, an inch and a half long by one inch in diameter. In applying them they should be ignited at the top, and held upon the part intended to be cauterized with a pair of dressing-forceps, a long hair-pin, or a porte-moxa; care being taken to protect the surrounding surface with a piece of wet linen perforated at its centre. When it is desired to hasten the combustion a blowpipe may be employed, but in general this is unnecessary. Whatever substance be used, the heat can be so graduated as to produce any amount of irritation, from the slightest rubefaction to a superficial eschar. When the latter effect is desired, the moxa should remain on until it is wholly consumed; otherwise it may be removed as soon as the pain becomes somewhat severe; or, instead of placing the burning material in contact with the skin, it may be held at a little distance from it. The eschar is of a yellowish, gray, or dark color, and usually drops off in six or eight days. The pain produced by the operation may be promptly relieved by the application of liquid ammonia, cold water, or pounded ice.

The moxa seems to act on the same principle as the objective cauterization, and the ammoniated counter-irritants, already spoken of, and is a valuable agent in many chronic cases, when it is intended to produce a sudden impression upon the nerves of the affected part: it should always be applied as near as possible to the seat of the malady, and the effect should be sustained for weeks, or even months, by the repeated application of the agent. The diseases in which it seems to be most efficacious are amaurosis, neuralgia, nervous deafness, partial paralysis, coxalgia, and spinal irritation.

An effect similar to that of the moxa may be produced by the objective cautery, as it is termed; that is, by passing a piece of iron, heated perfectly white, rapidly over the surface at a distance from three to five inches. The skin becomes almost instantly red, and, if the application be continued for a few minutes longer, vesication will follow.

6. *Acupuncturation.*—Counter-irritation may be effected also by acupuncturation. This consists in the insertion of very slender, well polished, sharp-pointed steel needles, from two to four inches in length, furnished with a head of sealing wax. To prevent them from breaking, they should be rather soft and flexible. They are introduced into the affected part, which is previously stretched, by a gentle rotatory motion, aided by slight pressure, and are suffered to remain from one to six hours, according to the effect they produce, or the object they

are intended to fulfil. In some instances a period of ten minutes is sufficient; in others, they may be kept in for one or two days. They may be carried to a depth of several inches, but care must be taken not to transfix any important viscera, vessels or nerves, though this has been often done without ceremony, and without any injurious results. The number of needles to be used varies from one to a dozen, according to the extent of the affected part and the sensibility of the patient. The operation rarely causes much pain, and is scarcely ever followed by any unpleasant symptoms. In most cases a slight blush, which subsides in a few hours, is observed around each puncture. In withdrawing the needles, which is sometimes effected with difficulty, owing to their having become oxidized, a movement of rotation should be given to them, at the same time that pressure is made upon the adjacent surface with the thumb and forefinger.

Acupuncturation has been employed in a great variety of affections, as neuralgia, rheumatism, gout, sciatica, paralysis, cephalalgia, and epilepsy; recently it has been recommended in the treatment of aneurism, hydrocele, varicocele, and anasarca. Its advantages have been much overrated, and the practice, which has been borrowed from the Chinese and Japanese, has fallen into disrepute.

7. *Electro-puncturation.*—Needles are sometimes introduced into the tissues for the purpose of transmitting to the affected part a current of electricity or galvanism. The operation, denominated, in the one case, electro-puncturation, and in the other, galvano-puncturation, is performed in the same manner and with the same instruments as in the ordinary process, except that the latter have a small ring at the top for receiving the conducting wires of the poles of the battery. Only two needles are used at first, but the number is gradually increased as the patient becomes able to endure the action of the current. When it is intended to produce a shock, a Leyden jar may be employed, but for maintaining a steady effect a small horizontal galvanic pile is the most appropriate apparatus. This mode of counter-irritation is almost entirely restricted to the treatment of chronic affections, attended with deep-seated and inveterate pains, as gout, rheumatism, neuralgia, and sciatica.

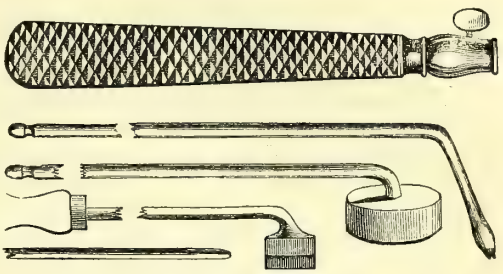
SECT. VI.—ESCHAROTICS.

There is a class of operations which consist in destroying the affected tissues with caustics, consisting of the hot iron, and of various escharotic substances. These procedures, however, once so much in vogue among surgeons, have become almost obsolete, although they are perhaps still too much practised in certain quarters, especially in France. At the present day they are restricted, in great measure, to affections of the neck and orifice of the uterus, and of the mammary gland, hemorrhoidal tumors, varicose veins of the extremities, specific ulcers, as chancres and malignant pustules, and the bites of snakes and rabid animals.

When the hot iron is used for the purposes in question it should be

heated to a white heat, and retained in contact with the diseased parts sufficiently long to effect their destruction, their surface being previously thoroughly dried. In performing the operation, the surrounding structures should be carefully protected from injury, and in order to obtain the desired result it is frequently necessary to have two, three, or even four cauteries in readiness, so that, as one becomes cold, another may take its place. The eschar generally drops off at a period varying from four to ten days. The best apparatus for heating the iron is a little furnace, charged with charcoal, the combustion being promoted with a pair of bellows. The annexed sketch (fig. 116) conveys a good idea of the principal forms of iron in use at the present day. The conical shaped instrument is well adapted for cauterizing narrow and deep-seated cavities; the cylindrical one may also be used for this and similar purposes. The hatchet-shaped iron is well adapted for making a linear eschar, and the large round one for establishing a deep, permanent issue.

Fig. 116.



Different forms of cauteries.

Caustic potassa, the Vienna paste, chloride of zinc, bichloride of mercury, arsenic, ammonia, and certain acids, as the nitric, hydrochloric, and sulphuric, are powerful caustics, producing their peculiar effects more or less promptly, according to the length of time during which they are retained, and the strength in which they are used. As their application is generally attended with severe pain, it is proper that the patient be previously put under the full influence of an anæsthetic. Moreover, as some of the articles here specified have a tendency to diffuse themselves over the surrounding healthy surface, care should be taken to prevent this by placing a wall of simple cerate or collodion around the part to be cauterized.

Caustic potassa is a powerful escharotic, but as it is extremely painful and very tardy in its action, it is now seldom employed. The Vienna paste, composed, as already stated, of equal parts of quick lime and caustic potassa, although also productive of severe suffering, does its work much more rapidly—generally in from ten to fifteen minutes—and is therefore usually preferred.

The chloride of *zinc* is usually mixed with farina, forming thus what is called the phagedenic paste of Conquoin, of which there are three strengths, known as number one, two, and three; the first consisting of one drachm of the metal to double that quantity of farina, the proportions of the second being as one to three, and of the third as one to four, the latter being of course much the weaker. The preparations act with great efficiency, but are productive of excessive pain.

Bichloride of mercury, in the proportion of three parts to one of pow-

dered opium, with the addition of a sufficient quantity of sulphuric acid to convert it into a paste of the consistence of tar, makes a powerful escharotic; but, owing to the excessive pain which it causes, and the risk of its inducing salivation, is now rarely used. A similar objection is applicable to the caustic mixture, formed of equal parts of white arsenic and sulphur, formerly so much in vogue. A decisive escharotic effect may speedily be produced by the use of equal parts of ammonia and lard.

A very destructive escharotic, admirably adapted for the removal of epithelial growths, may be prepared with fifteen grains of white *arsenic*, seventy-five of cinnabar, and thirty-five of burnt sponge, made into a thick paste with a few drops of water. This constitutes what is called Manec's paste, and is applied in the form of a thin layer to the surface of the affected part, previously well cleansed, in order to promote its effects. The great objection to this remedy is the excessive pain it produces and its liability to cause vomiting, depending, doubtless, upon the absorption of some of the arsenic. Generally also its application is followed by deep discoloration and severe swelling. For these various reasons it should be employed with great caution.

The stronger *acids*, as the nitric, hydrochloric, and sulphuric, produce an instantaneous escharotic effect when applied to a denuded surface; hence they are often used for cauterizing inoculated wounds and destroying the edges of ulcers. Of all the acid preparations, however, the best and most reliable is the *acid nitrate of mercury*, of which frequent mention will be made hereafter. The formula which I employ is that usually known in this country as Bennett's. It is prepared by dissolving, with the aid of heat, 100 parts of mercury in 200 parts of nitric acid, and evaporating the solution to 225 parts. The application produces a white eschar, which is detached, piecemeal, in from the third to the tenth day. Whatever article be employed, the utmost care must be taken to prevent its diffusion over the surrounding healthy tissues, otherwise the effects may be most unfortunate. *Chromic acid* also deserves favorable mention; its application, which causes but little pain, is particularly valuable in cases of warty excrescences and of recent chancres.

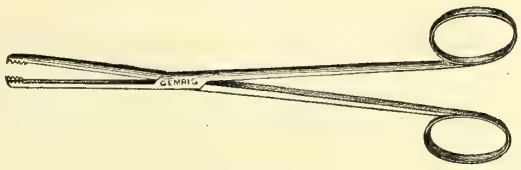
SECT. VII.—DRESSING.

The art of dressing, humble though it be, must not be despised by the surgeon; since, in many situations, both in private and hospital practice, it must necessarily form a part of his daily routine duties. There is, indeed, great reason to believe that this matter is too much neglected by practitioners, and that it is too frequently delegated to ignorant, careless, and unscrupulous nurses, and to the so-called dressers, who are often not a whit more enlightened, or more conscientious.

The most important appliances used in dressing are forceps, scissors, and syringes, sponges, lint, pledgets, tents, adhesive plaster, bandages, cataplasms, and unguents.

The *dressing forceps* (fig. 117), differ from the ordinary dissecting forceps in having ring handles, and cross blades, terminating each in a rounded, spoon-shaped extremity, supplied internally with serrated edges, to adapt it the better for seizing and holding such substances as may require removal. They are light and slender, and from four and a half to five inches in length. When not at hand, the ordinary dissecting forceps may advantageously be used as a substitute.

Fig. 117.



Dressing forceps.

The best *scissors*, for dressing purposes, are the ordinary straight pocket case instrument, which may be used either for cutting adhesive strips and bandages, or, if necessary, for paring the edges of ulcers, or for removing redundant granulations. Scissors curved on the edge or flat are sometimes very convenient.

The *sponges* used in dressing should be very soft and clean, and the same articles should never be employed upon different persons, especially when they are affected with open ulcers, as the discharges might thus be made the vehicle of propagating disease, as, for instance, in chancre, gonorrhœa, erysipelas, malignant pustule, and hospital gangrene. In all such cases they should be destroyed as soon as the dressing is completed, or thoroughly washed in water, and then soaked in a solution of chlorinate of soda.

As a general rule, no sore should be wiped; but the water should be pressed upon it from a sponge held some distance from its surface, which will generally effectually wash away any secretions that may be in contact with it. Adherent lymph, charpie, or unguent may be picked away with the forceps. The surface around, however, may be gently sponged, if soiled; otherwise it may be wiped with a soft dry cloth. The water may be tepid, cool, or cold, according to circumstances, and arrangements should always be made to receive it into a suitable basin, placed beneath the affected parts. The old dressings should be put into a separate vessel, and promptly removed from the patient's apartment. Fetor is allayed by the free use of the chlorides, sprinkled both upon the body and bedclothes, as well as about the room.

Lint is a soft, fleecy substance, consisting either of prepared cotton, or scraped linen, or, what is preferable, the ravellings of linen, as those of an old napkin, sheet, or pillow-case, each thread being picked out separately. The article generally employed in this country is patent lint, which is kept in rolls in the shops, and makes an excellent dressing, although not equal to linen ravellings, or the charpie of the French surgeons; one surface is glazed, the other smooth. The objection to it is that it is not sufficiently porous to admit of the free escape of the secretions of the parts to which it is applied, and, consequently, also, that it keeps them too warm.

Spongio-piline is now much employed as a dressing. It is a soft,

porous fabric, looking very much like a piece of sponge; it is made in sheets from half an inch to an inch in thickness, and being covered with a glazing of India rubber, is well calculated to retain water and prevent evaporation, at the same time that its weight is not so great as to cause oppression.

Sometimes the lint is arranged in the form of a *compress*, pledget, ball, roll, tampon, tent, or pellet, thus adapting it the more conveniently to particular purposes. Thus, a compress consisting of a strip of folded muslin or linen may be employed for pressing together the sides of a deep abscess, or a number of pieces may be piled upon each other, so as to form a graduated compress, which is often advantageously used for compressing a bleeding vessel, as the brachial artery where it runs along the inner edge of the flexor muscle. The *pledget* is a strip of patent lint, usually spread with cerate, for protecting the surface of a granulating ulcer; balls, rolls, and tampons are simply masses of soft substance, as charpie, lint, or cotton, arranged so as to adapt them to particular cavities, as the uterus, the nose, or a deep wound, either with a view of arresting hemorrhage, or for absorbing pus and other fluids. The *tent* consists of a piece of linen, muslin, or patent lint, twisted on its axis, slender, and usually several inches in length, its object being to prevent the reunion of the sides of the incisions made in puncturing abscesses, and in laying open sinuses, as in the operation for anal fistule. Tents are sometimes prepared with wax, in which case they are generally of a conical shape, and employed as dilators. Finally, the *pellet* is a ball, roll, or mass, of soft tissue, inclosed in a strip of soft cloth, firmly tied; it may be used for the same purposes as the tampon, of which, in fact, it is merely a variety. When intended for the nose, uterus, or rectum, a stout thread or piece of twine may be tied to it in order to facilitate its removal.

Within the last two years a good deal has been written respecting the use of *drainage-tubes;* a means of treatment suggested by Mons. Chassaignac, for favoring the discharge of matter from abscesses and sinuses, especially when large and deep-seated. These tubes, which are from one to two lines in diameter, and perforated by numerous oval foramina, are made of India rubber, and are, consequently, highly elastic and flexible; their shape is cylindrical, and their length varies from one to several inches, according to the exigencies of each particular case. The great objection to these tubes is their liability to become clogged, and their tendency to cause undue irritation in the parts into which they are introduced. For these reasons it is questionable whether they will ever come into general use.

Poultices form an important element in a great variety of dressings, but as these have already received sufficient attention, it would be out of place to say anything further respecting them here. I shall only add that, when they are selected for this purpose, they should be used with special reference to the comfort of the parts, care being taken that they do not oppress by their weight, or irritate by their long retention and the stimulating character of their ingredients. The mode of employing water-dressings has also been sufficiently considered

in another part of the work to render any further remarks concerning them here unnecessary.

Unguents, ointments, or salves of various kinds are employed as dressings in ulcers and other open surfaces; much has been said and written upon the subject, especially of late years, and attempts have been made to discard these substances altogether from practice. Still, notwithstanding all this, unguents hold a prominent place in the affection of many practitioners, as well as in that of the common people, and it would be difficult, I am sure, always to dispense with their use. I imagine that prejudice has had much to do in proscribing this class of remedies; when such a man as Liston raises his voice against any point of practice, it is usually very hard for the lesser lights of surgery to resist its influence, and the cry therefore at once becomes general, whether there be any just reason for it or not. It cannot be denied that rancid ointments act as irritants; but this is not the fault of the article, but simply of him who uses it. Prepared and employed for the occasion, my experience teaches me that their application is often attended with the most salutary effects, admirably protecting granulating surfaces, and rapidly promoting cicatrization. As a general rule, I have found that all the officinal medicated ointments are much too strong, requiring to be diluted from one-half to seven-eighths.

Whatever dressings be employed, they should be carefully confined by means of a bandage, evenly and lightly applied, so as to afford the requisite support, and no more. In most situations, this may be readily done with the common roller; but in certain regions, as in the groin, perineum, anus, and head, particular contrivances may be necessary, as the spica, the T bandage, and the four-tailed bandage. For retaining dressings upon the testicle and mammary gland the suspensory bandage will be found most convenient.

SECT. VIII.—BANDAGING.

Bandages are substances employed for retaining dressings in cases of wounds, ulcers, abscesses, fractures, dislocations, and other affections, as well as with a view to their direct curative effects, which, as will be shown by and by, are probably much greater than they are generally supposed to be. They vary much in shape and size, and also in regard to the materials of which they are composed, and the object which they are designed to fulfil. A vast number of bandages have been described in certain modern works, especially those on minor surgery, much ingenuity, and, according to my belief, much time having been wasted, in trying to adapt them to every part and region of the body, and to every circumstance, however insignificant, to which such contrivances can possibly be applied. By running into these extremes, the art of bandaging has been greatly complicated, and much injury inflicted upon a department of surgery, which, if properly administered, is capable of conferring immense benefit in almost every form of accident and disease affecting the external parts of the body. The ancient surgeons racked their brains to invent names for desig-

nating bandages, and the claims of not a few of them to distinction were based almost exclusively upon such absurd and puerile pursuits. If a man was so fortunate as to devise an apparatus for expelling peccant humors, for retaining a cataplasm upon the scalp, or for supporting a diseased breast, the height of his ambition was generally amply gratified. It is to be feared that these employments have had too many imitators in modern times.

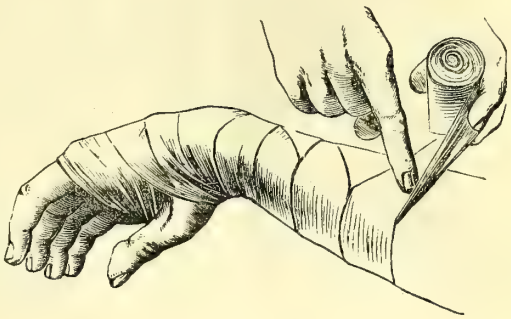
The more simple a bandage is the more likely will it be, if judiciously used, to answer the purpose for which it is intended; all complicated contrivances of this kind are objectionable on account of the difficulty of applying them, the ease with which they become deranged, and the trouble and vexation of changing them, the attempts to do so being frequently attended with serious inconvenience and pain to the patient, and perhaps great detriment to the parts affected. In general, the single-headed roller is all that can be required in almost any case; occasionally the strip-bandage, commonly known as the bandage of Scultetus, may be advantageously employed, especially in compound fractures and dislocations; the many-tailed bandage, in which the different pieces are sewed to each other, ought, on the contrary, to be discarded from practice, as inconvenient and useless.

Bandages are composed of various materials; generally of muslin, bleached or unbleached, of calico, or of linen, the only objection to the latter being its expense. Occasionally they are made of flannel, especially when it is desirable to protect the parts from cold, as in œdema of the extremities, and in the swelling attendant upon a gouty or rheumatic state of a joint, in persons of an unhealthy, broken constitution, who are commonly so extremely susceptible of atmospheric vicissitudes. In general, muslin will be found to answer every purpose, being both cheap, and easily procured; it should be soft yet firm, smooth, strong, and not too yielding, divested of selvage and seam, and washed before it is applied. Calico is not a good material for bandages, as it is usually too light and flimsy; I never employ it. In some cases, particularly in affections of the veins of the leg requiring steady and equable compression, gum-elastic cloth may advantageously be used.

The length and width of a bandage are of course subject to much diversity, depending upon the shape and size of the part to which it is intended to be applied. Hence, while in one case it need hardly be half an inch in width, and not more than a foot in length, in another it may require a width of two, three, or even six inches, as in injuries of the chest, and a length of many yards. Muslin is usually torn into the requisite sized strip, whereas linen, being much stronger, is best shaped with the scissors. The ravellings being picked away, each piece is rolled into a firm cylinder, and put away for use, so that it may be ready for any emergency that may arise. The winding may be effected either by hand, the cloth being held upon the front of the thigh, or by appropriate machinery, such as is to be found in the office of every practitioner, and of which illustrations may be seen in most of the works on minor surgery. However effected, it should be done with great care, since no one can possibly apply a bandage well that has been wound in a loose and slovenly manner.

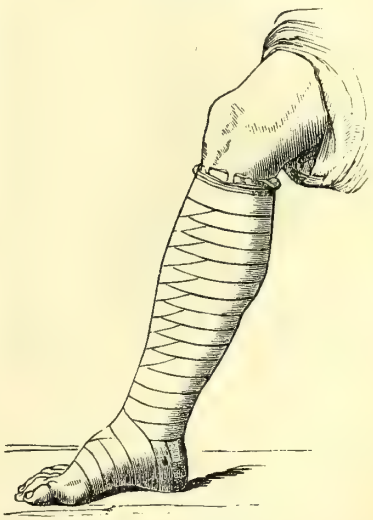
When intended to be used upon an extremity, the rule is always to begin at the distal portion of the limb, and to proceed from thence upwards some distance beyond the seat of the disease or injury. The end of the bandage being slightly unfolded is held firmly upon the part with one hand while the cylinder is carried round the limb with the other, and thus the application is continued by circular and reversed turns, as they are named, until the object has been completed, the fingers being pressed upon each reverse to flatten and equalize it (fig. 118). If the bandage were put on spirally, it could not maintain itself upon the limb for any length of time; but, what is worse, the compression would be so unequal as to cause severe suffering, and perhaps even mortification. The application, then, must be made circularly, and care taken that each turn of the roller be reversed, so that the inner surface shall be the outer, and the upper edge the lower, the pressure being uniform throughout, or not greater at one point than at another, as in fig. 119.

Fig. 118.



The evil effects of unequal compression by the bandage are well illustrated in fig. 120, copied from John Bell's works; it also shows how important it is always to begin the application of the bandage at the distal extremity of a limb, and not above the wrist or ankle, as happened in the case so graphically described by the celebrated Scotch surgeon. In all cases of severe injury or disease, with a tendency to swelling and to the extension of the morbid action, due allowance must be made for the inflammatory effusions that will necessarily occur. Hence, too much care cannot be taken both in applying the bandage and in watching its effects afterwards. For want of this precaution many a limb has been destroyed, and the reputation of not a few practitioners irretrievably ruined.

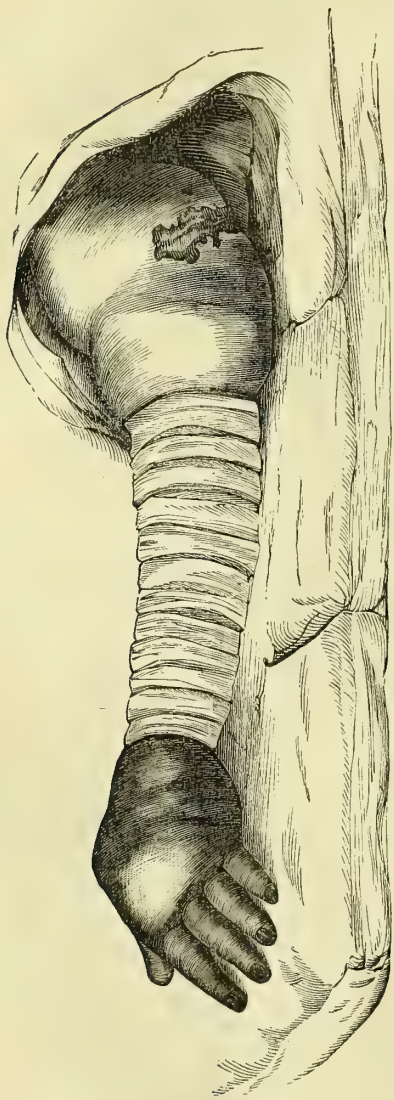
Fig. 119.



Appearance of the bandage after it has been applied.

Some surgeons are fond of employing the double-headed roller; but in a practice of thirty years I have never had occasion to resort to it, and am satisfied that there are few cases in which it may not be advantageously replaced by the single-headed, whose application has just been described. The double-headed bandage is considered as being particularly serviceable in the treatment of wounds penetrating deep among the muscles, where it is of paramount importance to effect accurate apposition of the deep as well as of the superficial sides of the solution of continuity; but even here no indication is presented that cannot be readily fulfilled with the compress and single-headed roller. In my own practice I have certainly never been at a loss in this respect.

Fig. 120.



Gangrene from strangulation of an injured limb by absurd bandaging.

The bandage of Scultetus consists of a number of strips, generally from ten to twenty, or of pieces of an ordinary roller, of equal or unequal length and breadth, according to the intentions of the surgeon. They are arranged in such a manner as that, when applied, each succeeding one shall overlap from one-third to one-half of the preceding one, the compression being made in the same gentle, uniform manner as in the employment of the ordinary roller. This form of bandage is peculiarly useful in the treatment of compound fractures and dislocations, in connection with which it will frequently be mentioned.

Bandages are sometimes applied wet; but in doing this much vigilance must be exercised, lest, shrinking too much as they dry, they produce a greater degree of compression than may be compatible with the comfort and safety of the parts. What is called the starched bandage, an excellent modern device, will receive particular attention in connection with the treatment of fractures of the extremities, to

which it is more especially adapted. When it becomes dry, it forms a stiff, firm, immovable case, well calculated to maintain the ends of the broken bone in contact with each other. Amidon, gum-shellac, plaster of Paris, and other kindred articles may be used for the same purpose, the bandage being wet with them, and immediately applied to the affected limb.

The bandage, viewed as a therapeutic agent, has been much neglected by modern practitioners. John Bell did much in his day to bring it into more general use than had been previously the case; and in this country no one is entitled to so much credit for the interest he has taken in this subject as Dr. Benjamin W. Dudley, of Kentucky. It is impossible to place too high an estimate upon the value of the labors of these distinguished surgeons in urging the importance of methodical compression in the treatment of injury and disease, and in pointing out the different classes of cases to which it is more especially adapted. Without fully sharing the enthusiasm of the American practitioner, everywhere conspicuous in his writings upon this subject, I have no hesitation in declaring that his teachings, in my judgment, are fraught with the most valuable instruction, and that they deserve a most careful and attentive perusal.

No one who has properly used the bandage, or who is capable of properly applying it, can doubt, for a moment, its great utility as a therapeutic agent; my experience with it for the last twenty-five years amply attests this fact; still, it is necessary that we should temper our enthusiasm, and that we should not allow ourselves to be betrayed into a species of hobbyism, calculated to mislead the judgment, and to bring surgery into discredit. Employed indiscriminately, it cannot fail, in many cases, to cause serious mischief, and to be followed by chagrin and disappointment. When the hand of a master is not present to direct and guide our practice, the result may frequently be most disastrous both to the patient and the surgeon. The evil effects of the bandage, in their aggregate capacity, are hardly less serious than those of mercury, the lancet, and other potent remedies; if they are, it is only because this agent is less frequently employed in practice. Numerous instances have come to my knowledge, where limbs, and even life, have been the forfeit of its injudicious use.

It is not difficult to perceive how the bandage acts in producing its salutary effects. In fractures and dislocations, as well as in large wounds, it powerfully controls muscular contraction, and at the same time prevents tumefaction, by giving tone and support to the capillary and other vessels. Its influence, as a sorbefacient is evinced in the rapid abatement of the swelling which so often follows compression by the bandage in erysipelas, œdema, and various kinds of injuries; or, more strikingly still, in orchitis, when, after the subsidence of the more active disease, the testicle is strapped with adhesive plaster, which is but another form of bandage. Here in a short time, ordinarily in less than twenty-four hours, the swelling usually so far disappears as to allow the organ to slip out of its artificial case, or, at all events, to such an extent as to require renewal of the dressing. The general effect of the bandage would thus seem to be somewhat similar to that of mer-

cury, controlling capillary action, and promoting the absorption of effused fluids; but it has the additional advantage, and no trifling one it is, that it supports the muscles and prevents spasm, as is so remarkably evinced in fractures and in the stump after amputation.

Of the extent to which bandaging may be carried, a good idea may be formed from the frequent allusion that will be made to it in different parts of the work; it will suffice here to observe that it is applicable, as a general rule, to the treatment of all classes of wounds, from the most simple to the most severe, to fractures and dislocations, ulcers, abscesses, erysipelas, whitlow, orchitis, chronic inflammation of the superficial veins, and to nearly all affections of the limbs in which there is an effusion of serum, or serum and plastic matter.

CHAPTER XIV.

OPERATIVE SURGERY.

Operative surgery has too often been regarded as an opprobrium of the healing art. This opinion, as foolish as it is unfounded, is not peculiar to the public, who, in matters of this kind, are generally but poor judges, but has frequently been advanced even by medical men. That this department of surgery is often abused cannot be doubted; but does it thence follow that it is a disgrace to the profession and an injury to the community? Such a view would be absurd, because it would be utterly irreconcilable with the dictates of common sense and the results of daily experience. As long as the human body is liable to accidents, and as long as nature is incapable of arresting, by her own efforts, the various morbid processes which she herself institutes, so long will practitioners be compelled to invoke the aid, and, I may add, the blessings, of operative surgery. Is it a disgrace to amputate a leg for a mortification of the foot, to extirpate a testicle that has been destroyed by cystic disease, to divide the stricture in strangulation of the bowel, to extract a stone from the bladder, to depress a cataract, or to trephine the skull in a punctured fracture? Surely, no one will doubt that in these, and a hundred other instances, our object can be attained only by an operation. Medicine, under such circumstances, however judiciously administered, is not only utterly futile, but is always ready to avail itself of the aid of surgery. Its empire is temporarily suspended, and it only resumes its legitimate functions after the use of the knife. It is true beyond doubt, and it is fortunate that it is so, that, in the hands of judicious and enlightened practitioners, a resort to instruments is much less frequent now than it was even ten years ago; many limbs which would formerly have been subjected to amputation are now easily saved; and many diseases which were once regarded as utterly hopeless now readily yield under the influence of our therapeutic efforts.

Operative surgery is progressive; it has done a vast deal, but a vast deal remains yet to be accomplished. If it has emerged out of chaos into order, and out of darkness into light; if it has laid aside its farago of instruments, and its fondness for blood; if, in a word, it has assumed the fair and stately proportions of a science, it owes it to itself to perfect itself in the greatest possible degree, as well as in the shortest possible time, in order that it may be still more entitled to the respect and admiration of the profession, and the gratitude of the public. It is only a disgrace when it is practised for base and selfish ends; not

when it interposes its resources for the purpose of removing disease and averting death.

Qualifications of a Surgeon.—The performance of operations presupposes the possession of certain qualities on the part of the surgeon. It is not every man that can become an operator, even presuming that he has the requisite knowledge of anatomy and of the use of instruments. Courage, which is so indispensable, is possessed by comparatively few; the sight of blood, and the idea of inflicting pain were so disagreeable to Haller, that, although he taught surgery with great success for seventeen years, he never, it seems, during all that time, performed a solitary operation upon the living subject. Courage, like poetry, has often been said to be a gift of nature, and nothing is, perhaps, more true; but it is equally certain that a timid man may, by attention to his education, and by constant practice, become, in the end, a good operator. Habit does a vast deal for us in such cases, for it literally becomes a second nature. I recollect a man, who, in his youth, nearly fainted at the sight of blood as it flowed from a vein of the arm into the basin, which it devolved upon him to hold during the operation of venesection, and yet, who, by a course of self-training and a complete knowledge of anatomy, has made himself a thorough master of the knife. Celsus, long ago, happily defined the qualities which constitute a good operator. He should possess, says the illustrious Roman, a firm and steady hand, a keen eye, and the most unflinching courage, which can disregard alike the sight of blood and the cries of the patient.

But the above are not the only qualities, important though they be, which should be possessed by an operator. If he is not honest in his purposes, or scrupulously determined, in every case, to act only with an eye single to the benefit of his patient, and the glory of his profession, he is not worthy of the name which he bears, or fit for the discharge of the solemn duties which he assumes. In a word, such an operator is not to be trusted; for he will be certain, whenever opportunity offers, to employ the knife rather for the temporary eclât which may follow its use, than for the good of the individual whom he unnecessarily tortures. He will not hesitate to amputate a limb, although the patient should die the moment he is removed from the table, or to tie the carotid arteries for a malignant disease of the eye, although he knows full well that such a procedure never has, in any instance, been of the slightest benefit. Such men, of whom there are, even yet, unfortunately, too many in our profession, deserve the name of knivesmen and knaves rather than of surgeons and honest men. No operation should ever be undertaken without due deliberation, and without a careful consideration of the various consequences involved in the result. Everything that is done should be done with reference exclusively to the patient; self should not have the slightest weight in the matter. The question, in every case, should be, is an operation necessary to save life, or to place the individual into a condition calculated to promote and insure his recovery? If this can be answered affirmatively, the operation should by all means be proceeded with; but if it be ascertained, clearly and satisfactorily, that it presents no such

prospect, both humanity and common sense dictate the propriety of declining it. It is a sad and humiliating spectacle to see a surgeon cut off a limb, or remove a cancerous tumor, merely for the sake of having it said that he performed an operation. I am daily shocked by the reports of cases of the extirpation of malignant growths in hospital, as well as in the private practice, of this and other countries. The question may well be asked, when will such silly and unmeaning, or, to use the proper expression, criminal procedures cease to disgrace our profession and to shock our sensibilities?

Every surgeon who wishes to make himself a skilful operator should have a most thorough knowledge of anatomy. His acquaintance with the healthy structures and their relations with each other should be so clear and distinct that he should be able to see them as it were in a mirror, or with his eyes shut. He should carefully study their color and consistence, that, seeing and feeling them, he may readily distinguish them from each other, and not be obliged to ask his assistants whether this is an artery, that a nerve, or this a tendon, a muscle, or a ligament. Nor should he limit himself merely to the study of healthy and relative anatomy. He should also have an intimate and comprehensive knowledge of morbid anatomy, or of the changes which are impressed upon the organs and tissues by disease and accident, and also of the various growths, formations, and deposits. The information thus derived will be of the greatest aid in facilitating the different steps of the operation, and enabling the surgeon to determine what to remove and what to spare.

No man can become an accomplished operator unless he practises constantly on the dead subject. Dexterity, grace, and elegance are to be acquired only by long and patient exercise. From what I have seen of our students, they are lamentably deficient in the use of the knife. Many of them, indeed, engage in the active duties of their profession without ever having performed a solitary operation on the cadaver, and hence it is not surprising that failure and disgrace should so often attend their early trials on the living subject. There should be, as I publicly declared more than twenty years ago, in every medical school a demonstrator of the operations of surgery, whose duty it should be to perform, in the presence of his pupils, all the operations on the dead body which it is ever necessary to perform on the living. Such exercises could not be too frequently repeated by the teacher, or too often performed by the student. In all operations, involving unusual anatomical complexity, a good plan is to make a thorough dissection of the parts immediately before their execution. Langenbeck and Lisfranc always adopted this method, and I have often profited by it in my own practice.

Preparation of the Patient.—No operation, unless it be of the most trivial nature, should ever be attempted without due preparation of the patient's system. The only exception to this rule is in case of emergency, where, in order to save life, we are obliged to act on the instant, without any precaution of this kind, and sometimes even without the necessary assistants. The character and amount of the preliminary treatment must, of course, vary in different cases and under

different circumstances, and do not, therefore, admit of precise specification. It may be stated, in general terms, that, if the patient be unusually plethoric and in the vigor of life, he should be bled at the arm, until he begins plainly to feel the effects of the loss, when the flow should be arrested. In opposite states of the system, however, such a procedure will not only be unnecessary, but might even be prejudicial. In all instances it is well to take into the account the probable loss of blood that will take place during the operation. If this is likely to be considerable, all preliminary abstraction must be carefully refrained from, even in healthy, robust subjects; for there can be no doubt whatever that a copious, or even a considerable, loss of blood before, during, or immediately after an operation has a marked tendency, in many cases, to retard recovery, and to dispose to the occurrence of erysipelas, pyemia, tetanus, and other ill effects. Indeed, so thoroughly am I convinced of the truth of this remark, that I feel as if it could not be urged too frequently, or too forcibly, upon the mind of the practitioner. It was formerly thought that a certain amount of hemorrhage, under such circumstances, would not only do no harm, but that it would positively be beneficial, by rendering the system less liable to inflammation. Modern experience, however, has shown that such an opinion is utterly untenable.

It would be difficult to conceive of any case, about to be subjected to the knife, where purgatives are not indicated, or in which, if they are not positively indicated, their exhibition would not be eminently beneficial. These remedies not only clear out the bowels, but they often exert a most salutary influence in modifying and restoring the secretions of the liver and mucous follicles, and it is just as much of a rule with me to prescribe them before my operations as it is to attend to the patient's diet. The best articles for this purpose are blue mass and colocynth, or calomel and rhubarb, either alone, or in union with a small quantity of ipecacuanha or tartar emetic. The latter substances are especially valuable when there is much disorder of the secretions, with headache and loss of appetite. Occasionally nothing answers better than, or hardly as well as, a dose of castor oil, Epsom salts, or citrate of magnesia. Independently of their direct cathartic effect, purgatives are often extremely useful in clearing out the bowels, where, as for example in lithotomy and in anal fistule, it is desirable to prevent any action upon them for several days after the operation.

A proper regulation of the *diet* is generally regarded, and very justly so, as of paramount importance. The extent to which this should be carried must, of course, depend upon the circumstances of each particular case; but, as a general rule, it should not, on the one hand, be too rigid or protracted, and, on the other, not too abundant. Much of the success of an operation is often directly traceable to the attention which is bestowed upon this subject. In most instances it will be advisable to enjoin entire abstinence from meat and the coarser kinds of vegetables, coffee and strong tea, hot biscuit, pastry, condiments, and, in short, all articles of an indigestible and heating nature. The quantity of food taken in the twenty-four hours should also be less than ordinary, for nearly, if not quite, as much harm may result from

an undue amount of mild and unstimulant food as from the moderate use of the more solid and substantial articles.

Finally, attention should be paid to the state of the *mind* and body. For some days, or even weeks, the most perfect quietude should be observed, especially if the operation is at all likely to be of a serious character. If, for example, the object is to extract a foreign substance from the knee-joint, or to perform an operation for the radical cure of varicose enlargement of the veins of the leg, it is hardly possible to use too much caution in this respect. In such cases the patient should not only refrain from exercise, but he should remain recumbent for several weeks, with the limb in an elevated position. In general, however, the restraint need not be carried to such an extent, a few days' confinement to the house being quite sufficient for the purpose.

The patient's mind should always be in as tranquil a state as possible. All business cares should be laid aside, and no outward troubles of any kind should be permitted to obtrude themselves during this probationary period. He should indulge in no unpleasant forebodings concerning the result of the operation, or, if this be inevitable, the surgeon should exert himself to the utmost to assuage and mitigate them by proper explanations. In a word, it is his duty, in all cases, to encourage the timid and console the desponding by every means in his power. A surgeon who neglects his duty in this respect is unfit to be intrusted with the lives of his fellow-beings. Many of our patients are from abroad, away from home and friends, and therefore peculiarly in need of sympathy.

I have never put off an operation on account of the particular *season* of the year. When it is recollected that the gravest accidents, requiring amputation, occur every hour of the day, and every day of the year, such a precaution would seem to be entirely at variance with common sense, if not wholly useless. I should certainly, however, not advise the undertaking of any serious operation in extremely hot weather, if it were possible to postpone it without detriment to my patient. The same objection, however, does not lie against very cold weather, inasmuch as a good fire and a properly regulated temperature of the apartment can generally be obtained without much trouble even in midwinter and in the most rigorous climate.

No operation, even of the most trivial nature, should be performed during the prevalence of an *epidemic*. This remark is particularly applicable to erysipelas, which, under such circumstances, is almost sure to ingraft itself upon the wound, much to the detriment both of the part and system. During an epidemic of this kind in Kentucky in 1845, '46, and '47, the slightest abrasion of the skin, a leech-bite, and the application of a blister, were often followed by an obstinate, and sometimes even a fatal, attack of the disease; and the consequence was that I was compelled, for many months, to decline the use of the knife nearly altogether.

Age is, as a general rule, no barrier to an operation. Even infants at the breast have occasionally undergone the operation of lithotomy, and in certain congenital affections, as occlusion of the anus and urethra, the knife is obliged to be used almost immediately after birth. I am,

however, as will be stated in its proper place, no advocate for very early interference in harelip; and I should say that it was best, as a general rule, to put off all severe operations in infants as long as possible, for it cannot be denied that they bear the shock and loss of blood, consequent upon such undertakings, much worse than persons of riper years and more developed constitutions. Very old people often bear operations remarkably well, and recover from their effects with surprising facility. Pregnancy should always be considered as a bar to the use of the knife, except in those cases in which it is imperatively demanded to save life. Even the extraction of a tooth is occasionally followed by abortion or miscarriage, from the perturbating influence which it exerts upon the system.

The *habits* of our patients should not be disregarded in considering the question as to the propriety or impropriety of operative interference, for there can be no doubt that they frequently materially influence the result. Intemperance of every description, especially if long continued, always modifies the constitution, and renders it less able, as a general rule, to bear the shock and subsequent effects of the operation than in ordinary cases. In habitual drunkards mania à potu, erysipelas, and unhealthy suppuration are of frequent occurrence after the use of the knife. Huge feeders, or persons who are fond of the pleasures of the table, and who take little exercise in the open air, are scarcely less exempt from these affections. Inordinate sexual indulgence, the habitual loss of blood, and debility from previous suffering, often place the life of the patient in danger after a severe operation. Fat persons, and individuals of a doughy, inelastic constitution, do not bear the knife so well as the fleshy and more robust. The same is true, and in a still greater degree, of strumous people. Nervous, hysterical females are bad subjects for some operations. Hospital patients, especially in the larger cities, do not, as a general rule, possess the same tolerance of the knife as private patients.

Should females be subjected to operations during the *menstrual* period, or just before its occurrence? Of the impropriety of such a course there can, as a general rule, be no doubt, yet there may be exceptions even here. Certainly no sensible surgeon would extract a cataract at such a time, or remove a diseased mamma, or, in short, perform any serious operation, if it can possibly be postponed. But, on the other hand, daily observation teaches us that women who are badly hurt during the menstrual period often make most excellent recoveries. Hence, I should deem it perfectly proper to perform at least any of the minor operations at this time, and, in fact, almost any other where delay might prove prejudicial.

There are certain *diseases*, even some which are not of a malignant character, in which surgical interference is wholly inadmissible, either for the time being, or altogether. I allude to those cases in which the malady, demanding operation, is complicated with other affections. Thus, in anal fistule, associated with tubercular phthisis, no surgeon, who has any consideration for his patient, or any respect for the art and science which he professes, would think of using the knife. The anal disease, in such a case, may be regarded as nature's issue, the

drying up of which would only be surely followed by an aggravation of the pulmonary symptoms. In stone of the bladder no one operates when there is serious organic disease of the kidneys, or even of the bladder itself. Amputation of a limb is never performed, except in case of accident, when there is an aneurism of the heart; nor is the femoral artery ever tied for popliteal aneurism when a similar affection exists in the arch of the aorta. In all malignant maladies, except the epithelial forms, a resort to the knife is of questionable propriety even in their earlier stages, and before there is the slightest evidence of the carcinomatous cachexia.

Indiscriminate operations cannot be too much condemned, as they are injurious alike to the patient, the reputation of the surgeon, and the true interests of science. Like a prudent general, the surgeon should know when to retreat as well as when to advance. It is difficult to conceive of anything more laudable than a bold undertaking in a case which must prove fatal without speedy relief. At the same time, it would certainly indicate a degree of weakness, if not of absolute wickedness, to attempt an operation when there is not the slightest prospect of benefit.

There is a class of operations to which the French writers have applied the term *complaisance*, that is, operations of expediency, not of necessity. An individual, for example, has an infirmity, as a distorted foot, or a contracted finger, which is a source rather of annoyance than of suffering or even positive inconvenience; his pride is piqued, and, as a consequence, his mind is incessantly disturbed by it, so much so, perhaps, as to be wholly disqualified for business and social enjoyment. Such persons often importune the surgeon's aid, and it therefore becomes a nice question how he should govern himself in regard to them. Shall he advise an operation, and run the risk of killing his patient, or shall he refrain, and persuade him to bear his cross, for such it actually is? There can, I think, in general, be very little difficulty in arriving at a proper conclusion in such a state of things. For myself, I can see no difference between the physical suffering that is induced by a diseased bone and the mental distress that results from a deformed foot; as far as their effect upon the comfort and happiness of the individual is concerned they are precisely on the same level, and hence, if it be right and lawful to amputate in the one case, why should it not be in the other? If a young man has a varicocele, even of moderate size, and it completely destroys his happiness and usefulness, not by its physical but by its mental effects, is it not our solemn duty to attempt relief by an operation, although the attempt should jeopard his life? I must confess, I should not hesitate as to the line of conduct to be pursued under the circumstances; at the same time, however, I should not omit to warn my patient of the risk he would be likely to run, and if, after a thorough explanation of the whole matter, he should still persist in his desire to be operated on, I should use every possible precaution, by a course of diet, purgatives, and rest, to put his system in the best possible condition for sustaining the shock of the approaching ordeal. Operations, involving the same principle, though not the same risk, are of daily occurrence, and few

surgeons hesitate to perform them; I allude to the division of tendons in club-foot and strabismus, the extraction of the crystalline lens in cataract of one eye, when the other eye is sound, and other analogous affections.

Assistants.—There are but few operations which a surgeon can perform alone; in general, he is obliged to have assistants, and the number of these must necessarily vary in different cases and under different circumstances. Sometimes only one is required; at other times two, three, four, or even half a dozen will hardly suffice. The more simple an operation the less aid will commonly be necessary. In lithotomy an assistant holds the staff, two others support each a leg, one administers chloroform, another takes charge of the patient's hands, and a sixth presents the surgeon his instruments. In depressing a cataract, the operator usually requires only one assistant, to support the head and upper eyelid. Operations on children, especially when we are not permitted to employ anæsthetics, are often peculiarly embarrassing, and demand an unusual amount of aid for their successful execution.

The beauty, elegance, and rapidity, nay, even the success of an operation are often marred by the awkwardness of our assistants. To act well their part, they should be thoroughly acquainted with the different steps of the operation which is about to be performed, as well as with the nature and relations of the structures involved in it, so as to be able to anticipate every thought and wish of the principal. It is not necessary that they should be compelled, like so many Thespians, to rehearse the part which they are expected to play in the approaching task; but I should see that they were properly instructed in their business, and that they all perfectly understood their duty, which should always be carefully explained and assigned beforehand. Nothing can be more awkward for a surgeon than to stop in the midst of an operation to ask for a knife, sponge, or ligature; once begun, every thing should proceed with the utmost regularity, and without the slightest interruption from any cause. Good, well-trained assistants are, unfortunately, not always to be obtained; the older members of the profession are too much occupied, or too jealous of each other, to afford their services, and the younger are too often ignorant of the duties required of them.

Duty of the Surgeon.—When the surgeon has a perfect control of his time, as he almost always has, except in cases of emergency, he generally selects a particular hour for performing the operation. The best period of the day, at least in this country, is from 11 to 2 o'clock, as he will then have a good light, and also be in a better trim for the discharge of his duty. An operation, especially an important one, should never be performed late in the afternoon, or in cloudy weather; for, should hemorrhage arise, he might be sadly puzzled in his attempts to arrest it, on account of the want of a good light, which is so indispensable on such occasions.

At the hour specified for the operation everything should be in its place; the assistants should attend with military punctuality; the table should be properly prepared; the chloroform, ammonia, and brandy,

instruments, ligatures, sponges, water, and napkins, should all be at the precise spot where they are required; in short, nothing should be wanting, but everything be at hand, and arranged in the most perfect order. I have heard of a surgeon, engaged in an amputation, make his flaps, and ask for his saw, which had been left in an adjoining room! On one occasion a lithotomist performed the lateral section, and was about to introduce the forceps to extract the stone, when, lo and behold, the instrument had not been put on the tray! Such blunders might create a smile, if they did not sometimes involve serious consequences. It need hardly be added that all these preparations should be made in an adjoining room, away from the patient; it is enough for him to know that he is about to suffer, without seeing the instruments of his torture deliberately spread out, one after another, before his eyes.

Of the precise time, as to the day and hour, of the operation the patient should usually be kept in ignorance, as the information, if made, could hardly fail to exert a perturbating, and, consequently, a prejudicial influence upon the mind, and, through it, upon the general system. It is only in the milder cases that this intelligence should be communicated. There is, however, much difference in this respect in different individuals; for, while some would shrink from the disclosure, and be, perhaps, seriously affected by it, others will not only be indifferent to, but absolutely court it.

Position of the Patient and Surgeon.—The position of the patient, the surgeon, and the assistants must vary, of course, in different cases, and can be discussed here only in a general manner. When chloroform is to be given absolute recumbency is required, to guard not only against delay, but also against the occurrence of serious mishaps. But, apart from this consideration, the horizontal posture should always be preferred whenever the operation is likely to be protracted, or attended with much shock and loss of blood. In other cases, again, as in lithotomy, the operation cannot be performed in any other position than in the recumbent. In amputating the thigh and leg, as well, indeed, as the arm and forearm, the patient always lies down, not only on account of apprehended weakness, but because it is always easier, when he is thus placed, to hold the limb and control hemorrhage. In lacerating a cataract, the patient generally sits in a chair, with his head supported upon the breast of an assistant; in operating on hare-lip the child usually sits upon an assistant's lap, the head being firmly held by another assistant, standing behind or by the side of the first. In lithotomy, the patient lies on his back with the breech reaching over the edge of the table, two assistants support the legs, another holds the staff, a fourth takes charge of the sponges, and a fifth administers chloroform, while the surgeon sits on a low stool in front of the perineum, or, as I usually prefer, rests on one of his knees. Now, that anæsthetic agents are so much in vogue, it is seldom that we are obliged to tie our patients, or to roll them up in sheets or aprons, as was the custom prior to the discovery of these most useful remedies.

Operation.—Everything being thus prepared—the assistants being at their posts, the instruments arranged upon a tray in the order in

which they are likely to be required, the parts divested of hair and dressings, and the patient fully under the influence of chloroform—the operation is proceeded with, slowly, deliberately, and in the most orderly, quiet, and dignified manner. All display, as such, is studiously avoided; ever remembering, in the language of Desault, that the simplicity of an operation is the measure of its perfection. No talking or whispering should be permitted on the part of the assistants, and as to laughter, nothing could be in worse taste, or more deserving of rebuke. Every important operation should be looked upon as a solemn undertaking, which may be followed in an instant by the death of a human being, whose life, on such an occasion, is often literally suspended by a thread, which the most trivial accident may serve to snap asunder.

The time occupied in performing an operation is a matter of some moment, but not as much, perhaps, as is commonly supposed. When a patient is unconscious, whether from cerebral oppression, or from the use of an anæsthetic agent, it is of very little consequence, other things being equal, whether the operation last five minutes or ten minutes, provided it is well executed, which it certainly cannot always be when we aim at great speed. Le Cat, it is said, lithotomized half a dozen patients in nearly twice as many minutes, and the result was that he lost nearly every one. Prior to the application of chloroform to the relief of suffering, rapidity was most commendable, inasmuch as it served to prevent shock and pain, though I firmly believe that it was often secured at the expense of much subsequent mischief, if not immediate detriment. The maxim of the schools has always been *cito, tuto et jucundo;* but, as it respects the first of these injunctions, it may be added, in the language of Cato, *sat cito si sat bene.*

Accidents during Operation.—The next topics to be considered are the accidents which are liable to take place during the operation, and the best methods of avoiding or meeting them. These are, first, hemorrhage, and secondly shock.

The amount of blood lost during an operation may be very small when measured by ounces, but very large in relation to its effects upon the system. Much will depend, in every case, upon the state of the constitution, and the temperament, habits, and health of the patient. A hemorrhage which may affect one individual very slightly, if, indeed, at all, may affect another most seriously and even fatally. A good deal, again, will depend upon mere idiosyncrasy, and upon the presence or absence of epidemic disease, which, as has already been intimated, generally impresses itself, to a greater or less extent, upon every individual in the community in which such disease prevails. Anything like a copious loss of blood is, as before stated, a great evil, and should, therefore, always, if possible, be prevented. I cannot agree with those who think that the loss of twelve, sixteen, or twenty ounces will be likely to be beneficial, even when there is unusual vigor of constitution. If there be any undue vascular repletion, it can always be relieved, if the necessity for it arises, after the operation is over. In all cases, therefore, I deem it to be our duty to guard against hemorrhage as much as possible.

It is not necessary, nor even proper, to tie every vessel as fast as it is divided. A well-trained assistant will generally obviate this necessity by compressing the bleeding orifice the moment the knife has swept beyond it, and by the proper exercise of this dexterity a large tumor may often be removed before a single ligature is applied. Should the bleeding, however, not be controllable by this means, steps must be taken to arrest it without the least delay by ligating the principal vessels from which it proceeds.

It is seldom, at the present day, that a patient sustains anything like a serious shock from an operation, even if it be comparatively severe and protracted. The use of anæsthetics, if it do not always effectually prevent, generally restricts it within the limits of tolerance, and thus saves the surgeon a vast amount of trouble and anxiety. It is not, however, to be forgotten that the very means which are employed to prevent pain and shock may themselves induce severe, if not fatal, prostration. Hence, as will be seen by and by, too much caution cannot be used in their administration; the effects of the remedy should be most carefully watched throughout, so that any symptom denotive of danger may be instantly recognized and counteracted. By keeping the patient perfectly recumbent, and providing for the free admission of air into the lungs, all mischief may, in general, be happily avoided. The syncope, caused by the loss of blood, is met by a depressed position of the head, by means of the fan, by dashing cold water upon the face and chest, by holding smelling-bottles *near*, not to the nose, and, in severe and alarming cases, by sinapisms to the extremities, spine, and præcordial region, aided, if necessary, by the use of stimulating injections, as brandy, turpentine, ammonia, or mustard.

Dressings and After-treatment.—The operation being over, the next thing to be done is to adjust the dressings; these should always be as light as possible, and applied in such a manner as shall insure the greatest chance for union by the first intention. The question has been much agitated of late years, whether the dressings should be applied at once, the moment the knife has accomplished its object, or whether the parts should be permitted to remain free for several hours, to afford them an opportunity of contracting and becoming glazed with plastic matter. Much might be said in favor of both methods. The proper rule of practice, I think, is to steer a middle course, adopting neither plan exclusively. In large wounds, as those, for example, left in amputation of the thigh, leg, or arm, and in the extirpation of large tumors, the best plan always is to keep the parts open for three, four or five hours, or until all oozing has ceased, and the raw surface has become incrusted with plastic matter, a light and porous napkin, properly folded and frequently wrung out of cold water, being kept constantly applied to promote these occurrences. If, under such circumstances, approximation be effected immediately after the operation, the surgeon will often be compelled, a short time afterwards, even when he has taken the greatest possible care to secure the vessels, to remove his dressings, in order to arrest the flow of flood; a procedure which is generally not less painful and alarming to the patient than disagreeable and vexatious to the attendant. If, on the other hand, the wound

be small, the best plan, I conceive, is to bring the edges together at once, as this saves both time and anxiety.

The dressing being applied, the patient is carried into his bed, previously prepared for his accommodation, and placed in such a position as will best promote his comfort and the reunion of the divided parts. Feathers and heavy quilts are to be carefully avoided; and, in general, it will be well, especially if there is a probability of there being much discharge, whether of blood, secretion, or excretion, to protect the bedding with a piece of thin, soft oil-cloth, spread beneath a folded, movable sheet. The affected parts are placed in an elevated and relaxed position, and maintained, throughout, in a cool, comfortable state. The diet must be light and unirritant, the drink cooling and palatable, and the temperature of the apartment from sixty-five to seventy-five degrees of Fahrenheit. All unnecessary conversation should be avoided; and no persons, except the nurse and the immediate friends of the patient, should be permitted to enter the room during the first twenty-four hours after the operation, or, in cases of great danger and severity, not until a much longer time.

When the operation is at all severe, my invariable rule is to administer a full dose of morphia immediately after it is over, or even sometimes an hour or two before it is commenced. My object is not only to allay pain, which is always a great desideratum, but to induce sleep and tranquillity of the system; in other words, to put the part, body, and mind, all in a state of absolute repose for at least the first twenty-four hours after the use of the knife. By a full dose of morphia, I mean not less than one grain; a smaller quantity than this would only serve to fret and worry the patient, instead of composing him. In cases of unusual severity, I do not hesitate to give twice that quantity, never forgetting that excessive suffering always establishes a certain amount of tolerance to the use of anodynes.

Too much attention cannot be bestowed upon the patient's diet. If the operation has been at all severe, or attended with unusual shock and loss of blood, he must be fed, not starved, in order to enable the system to reinstate itself as promptly as possible into its former condition, by the manufacture of blood and nervous fluid, both, perhaps, frightfully expended during the previous contest, and now in danger of being still further exhausted by the traumatic fever and the tumultuous action of the heart. The vessels must be replenished; the brain and spinal cord supported. The most suitable articles, for this purpose, are milk and stale bread, with the free use of brandy, followed, in a day or two, by animal broths, rich soups, and the lighter kinds of meats. Sub-acid fruits will also generally prove both grateful and nourishing. The drinks should consist of ice water, either pure, or acidulated, as may be most agreeable to the patient. A cup of tea is often exceedingly soothing and refreshing soon after a severe operation. Starvation after severe shock and loss of blood is often followed by the worst consequences, from the tendency which the system has to run into erysipelas, pyemia, and hectic fever, to say nothing of its incompatibility with the adhesive process.

But patients must not be fed indiscriminately after operations; when

the individual is young and robust, perfectly temperate in his habits, and, above all, when he has not suffered severely from shock or loss of blood, his diet should be restricted and be of the blandest character for a number of days, or, in fact, until the wound left by the knife is in great measure healed. Improper indulgence, under such circumstances, cannot fail to light up a fire which hardly anything afterwards may be able to extinguish.

Attention to the temperature of the patient's apartment is often a matter of great moment; in general, it will be best to regulate it by the thermometer, especially in operations on the respiratory organs, and after the extirpation of ovarian tumors. Everything like a direct draught must be carefully avoided, and in wet weather it will be a good plan to shut the windows.

Some of the above precepts may seem trivial; but I am sure that they are of the greatest importance, and that the want of their observance is often followed by the worst consequences. It is a much easier matter to talk a patient to death, or to retard his recovery, after he has undergone a severe operation, or sustained a violent injury, than most people imagine. Should symptomatic fever arise, or should the parts exhibit evidence of over-action, prompt recourse must be had to the usual antiphlogistic remedies, employed in a decided yet cautious manner, lest they produce harm instead of good.

The after-treatment should always, if possible, be superintended by the surgeon himself; his duty is not over with the operation; it ceases only with the cure or death of his patient. "The practice," remarks an eminent authority, "of performing a serious operation, and leaving the after-treatment to others, has, in my knowledge, repeatedly proved disastrous. The medical treatment, a duty not less responsible than the operative, belongs to the surgeon, and, indeed, to be employed merely as a handicraftsman, conveys an imputation at which the dignity of a scientific mind revolts."

Dangers after Operation.—The great sources of danger, after a severe operation, are first, excessive depression of the system from shock and loss of blood; secondly, traumatic fever; thirdly, undue inflammation of the parts; fourthly, secondary hemorrhage; fifthly, erysipelas; sixthly, pyemia; seventhly, tetanus; and, lastly, constitutional irritation.

a. The *prostration*, consequent upon an operation, is usually denoted by great pallor of the countenance, feebleness of the pulse and respiration, coldness of the extremities, yawning and sighing, partial blindness, dizziness, noises in the ears, restlessness, thirst, nausea, and even vomiting. To meet these symptoms, all that is necessary, in general, is to place the patient recumbent, to use heat, friction, and sinapisms, to allow a free access of air, and to administer stimulants, as brandy, or brandy and ammonia, by the mouth, if the power of deglutition still remains, or, if not, by the rectum, in the form of enemata. A full anodyne will usually form a most valuable adjunct to these remedies, and should seldom, if ever, be omitted. Great care, however, must be observed in the management of these cases, lest violent reaction follow the depression, and hurry the patient on to a fatal termination. It is

only in instances of extreme prostration that stimulants should be given boldly and freely, and without any regard to future consequences in respect to the parts involved in the operation.

b. More or less *fever*, usually denominated traumatic, must almost necessarily follow every severe operation; it generally comes on within the first six or eight hours, and is characterized by a flushed appearance of the face, a frequent, quick, and irritable state of the pulse, dryness of the skin, restlessness, and thirst, which is often excessive, especially after profuse losses of blood. The proper remedies are cooling drinks, taken in proper moderation, or ice, if there be nausea, or gastric oppression; sponging the surface with tepid water; mild laxatives; and the neutral mixture with a minute quantity of antimony and morphia, to promote diaphoresis. If the symptoms are disposed to continue, more active measures may be required, especially purgatives. This febrile commotion of the system is sometimes very deceptive, exhibiting an appearance of great violence, when in reality it is most slight, promptly yielding to the most simple remedies, or subsiding of its own accord. It resembles a sudden and violent storm, quite alarming, but altogether transient and harmless.

c. The resulting *inflammation* will rarely exceed the adhesive limits, if proper care has been taken to prepare the patient for the operation, and the parts have not been too roughly handled during its performance. But prevention is not always possible, and hence the wound should be diligently watched, lest it be assailed, and even overwhelmed before the patient and his attendant are aware of the fact; for it should be remembered that the morbid action is not always characterized, under such circumstances, by the usual symptoms; there may even be an entire absence of pain and tension, perhaps even of discharge. Great vigilance, therefore, is often necessary to detect the earliest inroads of the disease, and to counteract its progress. Of course, all officious interference is avoided, and nature is carefully protected in the maintenance of her rights and privileges. The moment overaction is perceived, the dressings are either removed, or, at all events, slackened, and suitable means substituted. Of these the most important consist of leeches, water-dressings, and cataplasms, either simple or medicated, according to the exigencies of the case. If matter form, free vent is afforded, either by a change of position of the parts, or by puncture and incision. Constitutional treatment, of course, receives due attention.

d. Secondary hemorrhage may come on within a few hours after the adjustment of the parts, or it may be postponed to a later period, even to a few days or weeks. It may be arterial or venous, slight or profuse, transient or persistent, just as in the primary form of the accident. The most common causes are, imperfect ligation of the vessels, defective dressing, sloughing, and premature detachment of the ligatures. Whatever they may be, they should be carefully sought out, and at once counteracted by appropriate measures. The occurrence is always to be deprecated, because it has a tendency, not only to alarm the patient and his friends, but to impede and even prevent the

adhesive process, requiring, as it not unfrequently does, the re-opening of the wound for its successful management. Fortunately, however, it is, in general, easily avoided, especially if proper attention be paid to the dressings and after-treatment.

e. Erysipelas is most apt to occur in persons of intemperate habits, or of a broken-down constitution, and usually makes its appearance within the first three days after the operation, generally at the site of the wound, or in the parts immediately around. Its presence is always denotive of disorder of the digestive apparatus, and hence one of the first things to be done is to administer medicines calculated to clear out the bowels and to restore the secretions of the liver, the mucous follicles, and the salivary glands. For this purpose the best articles are calomel and compound extract of colocynth, or blue mass and rhubarb, followed, if necessary, by the saline and antimonial mixture, with anodynes to allay pain and procure sleep. The local treatment must consist, mainly, of the dilute tincture of iodine, and solutions of the acetate of lead, with punctures and incisions to relieve tension and afford vent to effused fluids.

f. Pyemia may set in almost at any time after an operation, but the most common period is from the third to the eighth day. It is usually ushered in by bold and well-marked symptoms, such as violent rigors alternating with flushes of heat, severe cephalalgia, aching pains in different parts of the body, excessive restlessness, great thirst, a quick and frequent pulse, and inordinate dryness of the cutaneous surface. Delirium and extreme prostration soon ensue, and thus the case progresses from bad to worse, until, frequently in less than a week from the commencement of the attack, the patient expires in a state of utter exhaustion. Little is to be done for a system thus assailed. In nine cases out of ten the disease proves fatal. The proper remedies, at the start, especially if the patient is robust and plethoric, are moderate venesection and leeching, the exhibition of the milder purgatives, as calomel and rhubarb, and mercury with a view to a rapid constitutional impression. When excessive prostration is threatened, brandy, wine, ammonia, and nourishing broths are indicated, and must be administered with a generous hand. Locally, besides leeching, iodine, blisters, and medicated fomentations will be advantageous; if matter form, early and free incisions are made.

g. Still worse than pyemia, because even more fatal, is *tetanus*. This, however, is fortunately a rare occurrence after operations in this country. It is most common in tropical regions. In Europe and North America it is met with chiefly in dissipated persons of a broken-down constitution. It would seem that in India the operation of lithotomy is occasionally followed by this disease, an effect which, so far as I know, has never been witnessed in this country. Excessive loss of blood, severe shock, and exposure to currents of air, undoubtedly predispose to the occurrence of the affection, which usually shows itself within the first five or six days after the operation. The principal remedies are, anodynes, in full and sustained doses, brandy and ammonia, chloroform, and emollient applications to the wounded parts.

h. Finally, life may be assailed by *constitutional irritation* and profuse discharge, and that, too, long after all apparent danger is over. The patient gradually becomes hectic; his appetite and sleep fail; the bowels are irregular, at one time constipated and at another relaxed; and the parts, exhibiting an unhealthy aspect, refuse to heal. Such a state of things, which, in general, but too surely foreshadows an unfavorable result, is to be combated upon the same principles as hectic produced by ordinary causes.

CHAPTER XV.

PLASTIC SURGERY.

PLASTIC SURGERY is that branch of the subject which treats of the restoration of lost parts by the transplantation of healthy integument from some neighboring region. Originally restricted to the repair of the nose, it has, during the present century, busied itself in different ways, with the emendation of various other organs, and has thus greatly enriched the domain of general surgery; having, in fact, created a new department of operative medicine, as fertile in its resources as it has already been brilliant in its results. The extraordinary perfection which plastic surgery has attained within the last twenty years is truly wonderful, and affords a striking evidence of the ingenuity, talent, and enterprise of the medical profession in different parts of the world. It has literally been a field of conquests, upon which have been achieved some of the proudest triumphs of the human mind in modern times. Among the many names that are honorably associated with this department of surgery, on account of their persevering efforts to improve and advance its interests, those of Carpue, Dieffenbach, Blandin, Zeis, Serre, Liston, and Von Ammon, of Europe, and Pancoast, J. M. Warren, and Mütter, of this country, take deservedly a high rank. Several of these surgeons have composed able treatises on plastic surgery, and have thus indelibly identified their names with its history.

Various names have been devised to designate this branch of surgery. Thus, Blandin denominates it autoplasty, from a Greek compound literally signifying self-creation. Another French authority, Mons. Velpeau, prefers the word anaplasty, the true meaning of which is to reconstruct. By others the term plastic, from the Greek verb to mould, model, or adjust, is used, and this is perhaps less objectionable than any other; at all events, it possesses the advantage of being easily understood.

It is exceedingly probable that one branch of plastic surgery has been practised in India from time immemorial. In that country the barbarous custom has existed for ages of punishing certain classes of criminals by cutting off their noses, and there can be no doubt that sympathy for these poor wretches gradually induced persons to turn their attention to the means of affording them relief. Hence arose rhinoplasty, or the operation of making new noses, pursued chiefly by a low order of native priests, whose ignorance of the healing art was too profound to justify the idea that their efforts were often crowned with success. According to Galen, the ancient Egyptians were well acquainted with rhinoplasty, but self-interest and pride prevented them

from communicating a knowledge of it to other nations. Whether the operation was ever performed in Greece and Rome history does not inform us, although it can hardly be supposed that, if it had been, it would have been silent on the subject. In Europe attention was first prominently drawn to the restoration of lost parts by Gaspar Taliacotius, Professor of Anatomy and Surgery in the University of Bologna. In a work, on the subject, remarkable for its erudition, and the simplicity of its diction, published at Venice, in 1597, he has described with great minuteness the art of repairing mutilated noses, lips, and ears, illustrated by numerous engravings. It bears the title of "De Curtorum Chirurgia per insitionem," and is curious as furnishing a record of the observation and experience of a truly great surgeon soon after the revival of learning. His practice must have been very great as a rhinoplastic surgeon, for it is distinctly stated that patients visited him from all parts of Europe. The pupils of Taliacotius, settling in different parts of the continent, took great pains to disseminate a knowledge of the operation among the profession, although it does not seem to have been often applied in practice, doubtless from fear of failure. The operation, moreover, was doomed to encounter many obstacles from ridicule, which always exerts a powerful influence upon the weak and prejudiced in every country, and not unfrequently has the effect of throwing a new and useful invention completely into the shade.

The method of Taliacotius consists in borrowing the required material from the arm; the operation is very tedious and complex, and has been almost entirely superseded by the Indian method, in which the flap is taken from the forehead. These two processes will be described in their proper place. Meanwhile, it may be observed that the Oriental operation was first successfully performed in Europe in 1814, by Mr. Carpue, of London, who, in 1816, published an account of this and of another case, equally fortunate. To Dieffenbach, however, more than to any one else, is due the merit of having first generalized the operation, by pointing out the sphere of its application.

The nomenclature of these plastic operations has assumed quite an imposing character, from the numerous structures to which they are applicable. It is formed by adding the word plastic to the anatomical name of the part concerned, as rhinoplasty, genoplasty, and urethroplasty. Before I proceed to speak of these operations separately, it will be necessary to offer some remarks of a general nature respecting the causes which necessitate them, the preparation of the system, the proper mode of conducting them, and the character of the after-treatment.

The causes necessitating these operations are various kinds of accidents and diseases. Thus, in India, as already stated, rhinoplasty is generally required on account of wilful mutilation of the nose as a punishment for crime; in Germany, on the contrary, it is often called for on account of injury sustained by the small sword in duelling. The vicious cicatrices left by burns and scalds frequently lead to the necessity of their performance: in fact, a large field for plastic surgery has been opened in this class of lesions, in which good service was rendered by the late Dr. Mütter since attention was first directed to it. Of

the various diseases which may create a necessity for this kind of interference, carcinoma, struma, and syphilis occupy the first rank, these affections not unfrequently destroying the greater portion of the nose and lip, and thus causing the most disgusting deformity. Genoplasty is generally required on account of ulceration of the check from the effects of mercury; and urethroplasty, in consequence of urinary fistule, the result generally of stricture and abscess.

Whatever may be the causes leading to the necessity of these operations, none should ever be undertaken without thorough preparation of the system, extending through a number of days, if not several weeks. Upon this subject it is impossible to insist too strongly. I have seen enough of these cases to satisfy me that too little attention is paid to preliminary treatment, and that most of the failures which attend the procedure are due to the neglect of this precaution, for which there is the less excuse, seeing that there is never any need of immediate interference. There is no necessity, unless the patient is very plethoric, for the use of the lancet; light diet, rest, and an occasional purgative will generally suffice to bring down the system to a proper point of tolerance for the approaching ordeal. If the patient is from abroad, he must not be molested until he has recovered from his fatigue, and become accustomed, in some degree, to his apartment and to those who are to attend to his wants. Above all, let it be seen to that his room is spacious, cheerful, and well-ventilated. If the weather be cold, the temperature must be regulated by the thermometer, uniformity in this respect being of paramount importance to the success of the enterprise. No operation of this kind should be undertaken in the heat of summer.

It is hardly necessary to state that no plastic operation should ever be attempted so long as the disease necessitating it is not completely eradicated from the part and system. It would be the height of folly, for example, to undertake the restoration of a nose lost in consequence of constitutional syphilis if there were any traces of this affection, in any portion of the body, however remote, or however distantly connected with the disfigured organ; for there could be no possible guarantee here that the disease might not attack the new nose or the adjoining parts of the old, and so frustrate the design of the surgeon. Besides, even supposing that such an untoward occurrence did not take place, still it would be improper to operate, because the subjects of this disease are not only very prone to erysipelas but wounds in them generally unite with more difficulty than in healthy persons. The same remarks apply to struma, although I have great doubts whether this disease, by itself, ever destroyed any nose, ear, or lip. The mischief that is so often ascribed to it is nearly always done by syphilis, or by a combination of these affections from the transmission of the two poisons from the parent to the offspring. It is different with carcinoma. Here the plastic operation may, in general, be performed immediately after the excision of the specific disease.

The manner of performing the operation relates to the position of the patient, the surgeon, and the assistants; the administration of chloroform; the mode of selecting, making, and fastening the flaps; and several other circumstances which it is not necessary to specify.

If the operation be very simple, and likely to be soon over, the patient may sit up; otherwise he should lie down, his head and shoulders being properly supported by pillows. The surgeon and the assistants should dispose themselves in such a manner as may seem most useful for the prompt and successful execution of the operation. An anæsthetic is proper in almost every case, since the operation is frequently not only very tedious, but it is always desirable that the patient should be as passive as possible while it is in progress.

There are, as has already been stated, two points from which the integument may be transplanted for filling up the chasm in the mutilated organ; either from the immediate vicinity of the part, or from a distance. Thus, in making a new nose, or mending an old one, the flap may be taken from the forehead, according to the Indian method; or, if the gap be very small, even from the cheek, at a still shorter distance from the nose. Or the surgeon, adopting the plan of Taliacotius, now known as the Italian operation, may borrow the necessary material from the arm, although this method, owing to its tedious and complicated character, has become almost obsolete. In some cases the flap is obtained by a kind of migratory process, being successively transferred from one region to another until it reaches its final destination. Roux, in this manner, attempted to close an opening in the cheek, by inserting a piece of the lower lip into the upper, and, after a time, when the parts had contracted thorough adhesions and become accustomed to each other, transferring it to the place which it was intended permanently to occupy. Such a procedure would seem, at first sight, to be puerile, but upon reflection it will readily be seen that cases might arise where it would not only be justifiable but very proper.

However obtained, it is important that the integument should, if possible, be perfectly sound; free, not only from disease, but from scars. The importance of attention to this rule is too obvious to require comment. A cicatrice, having only a low vitality, is extremely apt to slough when transplanted. A sickly graft cannot take root on a sound bough, nor will a diseased bough permit the growth of a sound graft. To unite and maintain their future relations, both must be healthy. Another point of consequence is that the flap should be as destitute as possible of hair; for, although it might be divested of this after it has grown fast in its new position, yet it is always best not to incur any risk of unseemliness from this source.

The size of the flap must, as a general rule, be at least one-third larger than the opening which it is intended to cover, to allow for the necessary shrinkage. If the integument be very thick the contraction will be less than under opposite circumstances, but even here it is well for the surgeon to be on his guard, lest, when the cure is completed, the result should disappoint him. The shrinkage is always gradual, and generally continues for many months after the operation, the part gaining in thickness and density what it loses in circumference.

The shape of the flap must accurately correspond with that of the gap which it is destined to close. Hence the best plan is always to

define its outline before the operation by means of a pattern, placed upon the surface whence the integument is to be taken, and marked off with ink, nitrate of silver, or, what is better than either, tincture of iodine.

The composition of the flap is a matter of importance. It should consist merely of skin and areolar tissue, with a small quantity of adipose substance; muscular fibre, nerves, and veins being carefully excluded. The presence of a thin layer of fat is always conducive to the preservation of the flap, as it tends to protect the subcutaneous vessels, and facilitate adhesion. A large pedicle must always be left, otherwise the part may die from inadequate supply of blood and nervous fluid. No large artery should be embraced in it, as this would convey more blood into it than would be required for its nutrition, or than the veins could return.

These preliminaries being disposed of, the surgeon is ready to begin the operation. With a sharp scalpel he now pares the edges of the part to be repaired, vivifying them with great accuracy, and removing all redundant and callous matter; or he may first dissect up the flap, and do the paring afterwards, as fancy or convenience may dictate. In executing this step of the operation, great care must be taken not to press, or pinch, either with the finger or forceps, any portion of the flap or old skin, but to leave everything in as natural a condition as possible, since nothing will so readily promote reunion. The edges may be bevelled off or cut straight, according to circumstances, as will be more particularly described hereafter. The dissection is frequently attended with smart hemorrhage, but the rule is never to apply any ligature to the flap, lest it should interfere with the adhesive process, although any vessel that may spirt on the wound should at once be secured, and the wound itself promptly closed by suture. More or less gaping will of course remain, but it is astonishing how small a cicatrice is usually left even in the most extensive lesions of this description.

All bleeding having ceased, the flap is gently sponged, and accurately stitched to the edges of the chasm which it is designed to close. The most eligible suture will be found to be the interrupted, with an interval of from two to three lines between the threads, the ends being tied with a slip-knot over a narrow roll of adhesive plaster. The advantage of this procedure is that the suture may be loosened at any time if it be found to be too tight. Much harm is often done by placing the stitches too closely, the effect being to cut off the circulation. The twisted suture is objectionable for the reason, first, that the needles are, in many places, difficult of introduction, and, secondly, that they are liable to cause too great a degree of tension. The grooved suture, so happily used in plastic surgery by Professor Pancoast, will be described in connection with rhinoplasty, to which it is more particularly applicable.

The dressing is completed by covering the edges of the newly related parts with lint, spread with simple cerate, or wet with olive oil, in order to prevent them from becoming dry and shrivelled, an effect which is very liable to happen when this precaution is not duly

attended to. The surface of the flap may be protected with dry lint, or, what is generally preferable, be exposed to the air. If it is very large, it will be necessary to confine it lightly in its place with adhesive plaster and a bandage, but anything like firm pressure must be carefully avoided. The wound from which the flap has been borrowed is dressed with cold water, and a similar application may be made to the amended organ if appearances indicate that there is a likelihood of over-action. The operation being completed, the part is kept at rest in a relaxed and elevated position; a light, cooling diet is enjoined; and the air of the apartment is carefully regulated by the thermometer, an equable temperature being of the greatest consequence to the welfare both of the part and system. A full anodyne is given the moment the patient is put to bed; but, if things go on well, the bowels must not be disturbed under forty-eight hours, when they may be opened by a cooling laxative.

The sutures may be removed, on an average, from the third to the fifth day; but so long as they are doing well they should not be disturbed, and there are few cases in which it is proper to take them all away at once. Great attention to cleanliness must be observed, and the best mode of effecting this is to irrigate the parts occasionally with the syringe.

If undue swelling and discoloration arise, the patient must be promptly bled and purged, and such local means employed as shall be best calculated to meet the emergency of the case. Leeches may be applied to the neighborhood of the flap, but not to the flap itself for fear of exciting erysipelas. Occasionally, a considerable flow of blood may be obtained by slightly lifting the flap at one or more points, the bleeding being encouraged with a sponge and warm water.

The great danger after an operation of this kind is erysipelas, which may be so considerable as to destroy not only the flap but also the patient. Such an occurrence should be promptly met by the topical use of dilute tincture of iodine, and by appropriate internal remedies, especially quinine and iron; aided, if there be any tendency to a typhoid state of the system, by stimulating drinks and a generous diet. Now and then a patient is lost by pyemia, but such an event is fortunately very uncommon. Gangrene of the flap, either from inadequate nutrition, over-action, or undue constriction, occasionally occurs, and destroys the success of the operation.

For a time the flap remains pale and cold, but these symptoms soon subside, and are succeeded by a bluish appearance and an increase of temperature. The circulation is evidently temporarily embarrassed, the arteries conveying blood faster to the part than the veins can remove it. Hence a certain degree of stagnation ensues, followed by a bluish, threatening condition of the part, which, however, soon disappears spontaneously. Natural sensation does not return for a long time; it begins first along the edges of the flap, and thence gradually extends over the rest of its surface. For the first few months the transplanted skin may appear unnaturally large and unseemly; gradually, however, it becomes smaller and smaller, and eventually may shrink so much as to answer but imperfectly the objects of the operation.

CHAPTER XVI.

SUBCUTANEOUS SURGERY.

Subcutaneous Surgery is one of the creations of modern times, due chiefly to the genius and intrepidity of one man, Dr. Louis Stromeyer, of Hanover, who was the first to discover and to practise a subcutaneous operation, the undertaking consisting in the division of the tendo-Achillis for the cure of club-foot. The operation was performed in February, 1831, and eventuated in the complete restoration of the use of the limb. Prior to this period several attempts had been made, by different surgeons, to relieve this complaint, but they had all signally failed, simply because they had not been based upon correct scientific principles. The results of Dr. Stromeyer's observations and experiments were given to the profession in 1838, in a volume replete with interest, entitled Contributions to Operative Orthopædic Surgery, in which he has described, with circumstantial minuteness, the proper method of dividing the different tendons concerned in the production of the various distortions of the foot, with an account of the after-treatment.

Since the publication of Stromeyer, the domain of subcutaneous surgery has been greatly enlarged, by the application of its principles to other parts of the body, for the relief of which it has already performed the most valuable services. Dieffenbach, in 1839, gave it a new impulse by devising the operation for strabismus, which, although not practised by him subcutaneously, did much to inspire new confidence in the procedure, and to awaken a new interest in its application. Soon afterwards, however, the section of the muscles of the eye was performed without external wound, and the operation, originally suggested by Guérin, seems to be growing more and more in favor with the profession. The latter surgeon has extended the subcutaneous practice to the treatment of lateral curvature of the spine, by the division of the muscles of the back; and, at a more recent period still, it has been applied to the relief of numerous other affections, which would hardly admit of cure in any other manner. Among the more important operations which have grown out of this branch of surgery are the removal of cartilaginous bodies from the joints, the radical cure of hernia, the reduction of chronic dislocations, the evacuation of abscesses, the cure of anchylosis, and the obliteration of serous cavities. Too short a time has elapsed since the discovery of subcutaneous surgery to enable us to form a just estimate of its limits, or the extent to which it may with propriety be carried in practice; but it is not diffi-

cult to perceive that in a field, affording such unbounded opportunities for the exhibition of display and selfishness, much abuse must creep in, which time alone will be able to rectify.

The practice of subcutaneous surgery is founded upon the great law that all wounds and injuries occurring without an opening in the integument unite with very little, or, according to some, with no inflammation, and with no suppuration, differing thus essentially from similar lesions accompanied with a solution of continuity of the skin, which are always followed by considerable inflammation and also very frequently, if not generally, by a discharge of pus. This law, which is now universally recognized by surgeons, was clearly enunciated by Mr. John Hunter, in his writings, near the close of the last century, but did not attract the serious attention of his countrymen until within a very recent period; not, indeed, until the facts of the subcutaneous section had been placed upon a firm and immutable basis by the practitioners of the continent of Europe. The idea of the illustrious Englishman lay in his writings, like a pebble upon the sea shore, often seen but never observed, until accident directed attention to it years after the establishment, by others, of the great principles which he had so clearly enunciated. One reason, perhaps the chief one, of this was that he himself had never performed a subcutaneous operation; if he had, there is certainly no evidence of the fact in any of his writings. The only passage in his works which has any relevancy to the present subject is the following: "The injuries done to sound parts, I shall divide into two sorts, according to the effects of the accident. The first kind consists of those in which the injured parts do not communicate externally, as concussions of the whole body or of particular parts, strains, bruises, and simple fractures, either of bone or tendon, which form a large division. The second consists of those which have an external communication, comprehending wounds of all kinds, and compound fractures. Bruises which have destroyed the life of the part may be considered as a third division, partaking, at the beginning, of the nature of the first, but finally terminating like the second. The injuries of the first division, in which the parts do not communicate externally, seldom inflame, while those of the second commonly both inflame and suppurate." It is evident, from the tenor of this passage, that Mr. Hunter had carefully studied the influence of the air upon the effects of wounds, but it is not very clear, from aught that appears in it, that he had any conceptions whatever of the nature of subcutaneous surgery, properly so called.

Several of what are now dignified as subcutaneous operations have been performed for a long time. The mode of evacuating chronic abscesses by a valvular incision, first practised by Mr. Abernethy, early in the present century, legitimately belongs to this division of surgery, its object, as clearly enunciated by the originator, being the exclusion of the air, it being well known that the contact of this fluid with the pus in the interior of the sac was the cause of the excessive local and constitutional disturbance which so often followed the old mode of opening these collections. Of the value of this procedure there can be no doubt, although the class of cases which it is intended to relieve

is, from their very nature, unfortunately too often fatal. The operation of dividing the stricture in strangulated hernia, external to the sac, originated with J. L. Petit upwards of a century ago, but has only of late years received the attention it merits. Some of the English practitioners, commencing with Mr. Aston Key, have recently bestowed much attention upon the subject, and have adduced a body of testimony in its favor highly flattering to this mode of treatment. The object of the operation, whose advantages and disadvantages will be considered in their appropriate place, is, by relieving the bowel subcutaneously, to guard against the occurrence of the severe inflammation which so frequently attends the ordinary procedure, even in the hands of the best surgeons. The injection of hydrocele with irritating fluids, as suggested by Sir James Earle, early in the present century, is another instance of a subcutaneous operation, which has long been familiar to the profession, and been practised by every enlightened surgeon in Europe and America. Some recent writers have gone so far as to class the use of the seton in the treatment of ununited fracture among the expedients of subcutaneous surgery; such an application is certainly carrying this department altogether beyond its legitimate limits, and is therefore calculated to do the subject much harm by giving to it a wrong direction. The wound made by a seton is, to all intents and purposes, an open wound, followed not only by high inflammation but by profuse suppuration; occurrences which it is the peculiar province of subcutaneous surgery to guard against. A better example of a subcutaneous operation, performed for the relief of ununited fracture, is the division without wound, by means of a long, slender knife, of the soft tissues which form around the ends of the broken bone, the raw surfaces being afterwards approximated and maintained by appropriate apparatus.

On the whole, regarding subcutaneous surgery in its legitimate application, it appears to me that the cases to which it is adapted are susceptible of being arranged under the following heads: 1. Cases involving the division of tendons, muscles, and aponeuroses for the relief of various distortions, as club-foot, club-hand, spinal curvature, and strabismus; the reduction of dislocations, especially those of the foot; and the cure of anchylosis of the joints, depending upon contraction of the soft parts. 2. Operations for the radical cure of hernia, whether by puncture or injection; and division of the stricture in strangulated hernia external to the sac. 3. The evacuation of chronic abscesses and of purulent, serous, and sanguineous collections of the chest and other cavities, by a valve-like opening of the skin. 4. The withdrawal of cartilaginous concretions from the joints, as originally suggested by Goyrand and Syme. 5. Operations for obliterating serous cavities, when, in consequence of inflammation, they become occupied by serous fluid; as the vaginal tunic of the testicle, certain synovial burses, especially those about the hand and wrist, and various adventitious cysts, particularly those which are so liable to form in the neck in connection with the thyroid gland. 5. The comminution, by the knife, of diseased lymphatic ganglions, the incision of inflamed periosteum, and the division of morbid adhesions,

as those existing in chronic luxations, in depressions of the nose, and similar affections. 7. Forced extension of anchylosed joints, rendered so by the formation of fibro-ligamentous bands. 8. The subcutaneous obliteration of nevi or vascular tumors, by ligature or injection. 9. The operation for the radical cure of varicocele.

The mode of operating for subcutaneous purposes must vary of course according to the particular indication which it is designed to fulfil. Whatever, however, the object may be, the rule is to make as small an external wound as possible, consisting, in fact, rather of a puncture than an incision, for it is ever to be borne in mind that one of the cardinal aims of every procedure of the kind is the exclusion of the air. The knife with which the operation is performed must therefore always be very narrow, sharp-pointed, and rather short, a length of edge from half an inch to an inch being a good average. The annexed sketch (fig. 121) represents the knife which I have long been in the habit of using in all my subcutaneous operations. Such an instrument is generally much more manageable than a longer one, while one of greater width would make too large an opening. If the object be to evacuate an abscess, a medium-sized trocar may be used, the skin having been previously divided with a bistoury. The instrument is then passed for a variable distance—usually from an inch to an inch and a half—through the subcutaneous cellular tissue, when its point is plunged into the pyogenic pouch, its entrance being denoted by the want of resistance and the escape perhaps of a few drops of thin pus. In extracting cartilaginous concretions from the joints, a delicate knife is carried along under the integument through the capsular ligament and synovial membrane, which are then divided to a sufficient extent to admit of the displacement of the morbid growth, previously fixed by the thumb and fingers, into the cellular substance external to the articulation, from which, after the wound is healed, it is removed by a secondary operation. The operation for the radical cure of hernia, requiring instruments of particular construction and use, will be described in its proper place, and so in regard to several other procedures which cannot be noticed here.

Fig. 121.



Tenotome.

All operations of this kind should be performed with great gentleness and care; and whenever this is done there will be no risk either of severe inflammation, or of the division of any important vessels, nerves, or other structures not concerned in the particular affection for the relief of which the procedure is undertaken. I do not agree with those who maintain that tendons and other textures may be cut without the operation being followed by inflammation; on the contrary, I believe that a certain degree of incited action is present in every instance, and if this view of the case be correct it proves how important it is that it should be kept within proper limits. This subject, however, will again be adverted to in speaking of tenotomy. In general, the little puncture made in the operation unites in a few hours, while

the gap which intervenes between the retracted ends of the divided structures is gradually filled up by plastic matter, which is eventually converted into analogous tissue.

Most subcutaneous operations are nearly bloodless, and this circumstance constitutes one of their great peculiarities. While open wounds always bleed to a greater or less extent, those made beneath the skin by a narrow, sharp-pointed knife, used with proper care, are almost free from hemorrhage. In dividing the tendo-Achillis for club-foot, frequently not more than a few drops of blood are lost. As to shock, or serious depression of the nervous system, consequent upon such an operation, such an occurrence is never witnessed. The proceeding, however, is not always free from pain, especially during the efforts which are sometimes required to straighten the affected part after the division of the faulty structures; and hence it is often useful to administer an anæsthetic, the more so, because this not only prevents suffering, but, by rendering the patient passive, gives the surgeon a more complete control over his own movements.

Active preparatory treatment is rarely required in these operations. I have frequently performed the most extensive tenotomy at my clinic upon children whom I had seen for the first time only an hour before, and yet in no instance, so far as I have been able to learn, have any bad effects followed. The operations, however, for the radical cure of hernia, for breaking up adhesions in anchylosis, for the removal of cartilaginous bodies from the joints, and for the relief of some other affections, always demand more or less attention of this kind.

The after-treatment, for the first few days, is generally very simple. As soon as the operation is over, the little wound is covered with adhesive strips, to exclude the air, and the part, surrounded by a bandage, is maintained in a perfectly easy, quiet position. If active inflammation arise, which, however, will seldom be the case, the usual antiphlogistics must be employed. After nearly all of these operations suppuration must be prevented at all hazard.

When the operation has been practised for the relief of some deformity, as club-foot or spinal curvature, the cutting constitutes only a trivial part of the proceeding. The great care and trouble of the case come afterwards, in the fitting and wearing of the necessary apparatus. It is usually recommended that no apparatus should be used until after the lapse of several days, and this, as a general rule, will be found to be the best practice. I have, however, in many cases, so far deviated from this rule as to confine the affected limb at once, and usually without any disadvantage. Indeed, I have latterly thought that this ought to be the rule, and the delay the exception. As this subject, however, will have to be considered in connection with the various operations to which it relates, any further remarks upon it here would be out of place.

CHAPTER XVII.

AMPUTATIONS IN GENERAL.

SECT. I.—INTRODUCTORY CONSIDERATIONS.

THE word amputation was formerly employed, and is occasionally even yet, to signify the removal of various kinds of tumors; thus, many of the older writers speak of amputation of the breast, amputation of the jaw, and amputation of the scrotum. At the present day, however, the term excision is generally used as more appropriate in connection with these procedures, while that of amputation is applied exclusively to operations for the removal of the limbs whether in their continuity or at their articulations.

I cannot agree with those who have denounced amputations as a disgrace to surgery; it is only when they are performed unnecessarily that they ought to be stigmatized by the profession and the public as an evil. Every pursuit is liable to abuse, to sins of omission and commission, and it would be strange if limbs were not occasionally cut off that might, under judicious management, have been saved. To denounce amputations, and to declare that they afford evidence only of the impotency and imperfection of our art, is to take a very narrow and erroneous view of the subject. It is not intended, as far as our own feeble powers of reflection enable us to comprehend the matter, that man should be able to cure every disease to which "flesh is heir." There are many maladies, as well as accidents, which are of necessity mortal; lesions which no human agency can repair or remedy. Who can save a limb that has been mangled and cut to pieces by the passage of a railway car, by the explosion of a steamboat boiler, by the fierce contact of a cannon ball, or by a fall from the top of a house down upon a heap of stones? Where is the surgeon that can prevent mortification from a burn that has charred the flesh, from a cold that has completely frozen the toes and feet, or from a malignant pustule that has inoculated all the tissues of an extremity? Is surgery to be held responsible because it cannot cure cancer of the bones, scrofula of the joints, and aneurism of the thigh and leg? So far from imputing blame to it in these and similar cases, we should be grateful for the assistance which it is capable of affording us as a means of relieving suffering and prolonging life. It is under such circumstances, in particular, that we can best appreciate its great and inestimable value. If it were not for the merciful interposition here of the knife, such cases would inevitably be doomed to a rapid and miserable death. Morti-

fication would speedily do its work, the cancerous tumor would steadily spread and finally ulcerate, forming a frightful, disgusting, and painful mass of disease, and the scrofulous joint would soon wear out the system by hectic irritation. It is a sad thing to lose a limb, but it is also a sad thing to die; and what rational being, if he could have his choice, would not rather part with an extremity than with his life? No humane, enlightened, and conscientious surgeon will ever resort to amputation without being satisfied of its entire and perfect necessity; if he is young and inexperienced, he will be sure to avail himself of the best counsel within his reach, while, if he is thrown upon his own resources, he will not fail to give the case all the consideration and reflection that his own knowledge, wisdom, and judgment, may enable him to bring to his aid for the relief of the poor sufferer whom he is obliged to mutilate in order that he may rescue his life from the dangers which threaten him. I know of no operation which I approach with so much reluctance as the amputation of a limb, or one which gives me more real pain. To cut off an arm at the shoulder on account of an incipient cancerous affection of the head of the humerus, when the elbow, forearm, hand, and fingers are all perfectly natural and glowing with health, unconscious, so to speak, of the fate which awaits them, is enough to sicken the stoutest heart, and to discourage the boldest operator. If there be a more disagreeable task than this, I am ignorant of it; and yet I would not shrink from its performance even when there is but a faint prospect of prolonging life, if only for a few months. But the case is different, widely different, when the surgeon is called upon to amputate a limb crushed and lacerated by machinery; here there is no choice; no question concerning a cure by mere therapeutic measures; the knife is the only remedy, and the sooner it does its work the greater, as a general rule, will be the patient's chance of recovery. The body, it is true, is mutilated, perhaps sadly disfigured, but life is safe, and surgery, science, and humanity have achieved a real triumph. So long as there are accidents and diseases incurable by medical treatment, so long will there be a necessity for amputation, and happy is he who shall know when and how to perform it to the best advantage for his patient and the greatest credit to the art and science of surgery.

SECT. II.—CIRCUMSTANCES DEMANDING AMPUTATION.

The circumstances for which amputation may be required are not only numerous but extremely diversified in their character, and therefore deserving of the most careful consideration. They may be comprised under the following heads. 1. Mortification, however induced. 2. External injury, as wounds, fractures, and dislocations. 3. Morbid growths. 4. Aneurisms. 5. Diseases of the bones and joints. 6. Intractable ulcers. 7. Malformations and deformities. 8. Tetanus. The topics here enumerated comprise almost every kind of morbid action that can arise in the animal economy, and it will be perceived that they afford a wide and complicated field for the exercise of the

talents and judgment of the surgeon. Space will not permit me to enter as fully into their details as might perhaps be desired; but I shall endeavor to advert briefly to the more important facts included under each head, having already called attention to some of them in the chapters on gangrene and wounds.

1. *Mortification.*—Mortification, in whatever manner induced, necessarily imperils limb and life, and therefore often becomes the subject of amputation. Hence the question arises, under what circumstances is a resort to the operation advisable and proper? This question can only be answered satisfactorily by a consideration of the nature of the mortification. In the chapter on mortification is an account of the several varieties of this affection, the causes under whose influence they take place, their symptoms, and the means required for their relief. By a reference to that portion of the work, it will be found that, as it respects the operation under notice, the great rule, recognized by nearly all surgeons at the present day, in acute gangrene, is, to wait for the formation of a line of demarcation between the dead and living parts, on the ground that it is not generally safe to interfere sooner, lest the disease should reappear upon the stump, and thus destroy the patient, or necessitate a repetition of the amputation. Of the propriety of this rule there can be no question, for there is no surgeon of experience who has not witnessed its beneficial effects in his own practice, as well as in that of his friends, and yet it is equally true that it may occasionally be violated with great advantage. But I would apply to these cases the term "exceptional," comprising under this head those attacks of mortification which are so apt to supervene upon inflammation caused by external injury, as wounds, fractures, and dislocations, which often spread with immense rapidity, hopelessly overwhelming, if they be not promptly arrested, both the part and system in a few hours. It will not do for the surgeon, in such a case, to fold his arms and become an idle spectator; he must have his eyes and wits about him, or his patient is irretrievably lost; whatever is done must be done quickly. The wished-for line of demarcation will be looked for in vain; the gangrene will rapidly extend to the trunk, and death will soon close the scene. But in spontaneous mortification, or in mortification from erysipelas, carbuncle, and analogous affections, the judicious surgeon waits for the arrest of the morbid action, his chief care being to bring about this event as speedily as possible by appropriate local and constitutional measures. His rule of action is the same in hospital gangrene; in both cases means are employed for supporting the system, or, what is equivalent to the same thing, for improving the condition of the fluids and solids, and the knife is used only when the wished-for line of circumvallation is fully established, not a minute before.

In senile, chronic, or dry gangrene, the result usually of ossification of the arteries and of their occlusion by fibrinous concretions, thus depriving the tissues of their due supply of blood, the rule has heretofore been to wait for the cessation of the mortification, experience having shown that, when this precaution is neglected, the disease will be certain to reappear in the stump. It is in view of this liability in

mortification to recur that some surgeons, of great eminence and experience, have given it, as their judgment, that the case should always be left entirely to nature's efforts; in other words, that we should wait for spontaneous amputation, shaping the stump after the dead parts have been nearly completely detached from the living, when, it is alleged, the part and system will be better prepared to withstand the shock of the interference. The propriety of such advice is sufficiently obvious when it is considered that this disease occurs nearly always in very old and infirm subjects, and that it is essentially dependent upon obstruction of the arteries leading to the affected parts. Such individuals, as I know from personal observation, are usually very feeble, and have consequently very little power of resisting the effect of shock caused by the use of the knife, and the loss even of a small quantity of blood. Hence it often happens that they sink soon after the operation, even when there has been a distinct line of demarcation, or that the disease speedily breaks out upon the stump, and soon destroys life secondarily. Seeing how common these events are, would it not be wise in the surgeon, the moment he is brought in contact with these cases, to amputate at a great distance from the disease, ere yet the vital powers have been seriously assailed by the morbid action? to remove, for instance, the thigh at its middle, for senile, or chronic gangrene of the toes and foot. The only objection to such a procedure, it seems to me, would be where occlusion of the main artery of the limb reaches above the knee, a circumstance which could readily be determined by a careful previous examination. Where no such disease exists, and the general health has not yet materially suffered, I should not hesitate to resort to the expedient, under the conviction that, however severe, it was perfectly justifiable in a class of cases so unpromising as this confessedly is.

2. *Injuries.*—There are no lesions for which amputation is so frequently required as for wounds, fractures, and dislocations. Although they differ widely from each other in regard to the nature of the structures involved, these injuries may all be very properly classed under the same head, the more especially as they often co-exist, thus rendering it difficult to determine which of them is the most serious.

Of wounds, properly so-called, the only ones which require to be considered in connection with the present subject, are the lacerated, contused, gunshot, and railway. Wounds inflicted by rabid animals occasionally, it is true, demand amputation, particularly when they extend deeply among the bones, as, for example, when they occur in the hands and feet; but even in such instances complete riddance can generally be easily effected by a careful excision of the bitten parts, and the cauterization of the raw surface after the cessation of the hemorrhage. I should certainly hesitate to cut off an arm or leg under such circumstances; with the knife and saw I should expect to accomplish all that was necessary, in any case, for the safety of the patient.

Lacerated wounds, as well as contused and gunshot wounds, of a most frightful, and, at first sight, apparently of the most desperate character, are sometimes recovered from in an extraordinarily short

time, and with hardly any unpleasant symptoms. On the other hand, experience shows that the most insignificant injuries of this kind occasionally prove fatal in a manner and under circumstances which render it extremely difficult to account for the result. It would be a fortunate matter, both for the public and for the interests of science, if the surgeon could always form, if not a positive, at least an approximative estimate of the danger involved in each particular case of these wounds, for then it would be comparatively easy for him to adopt a suitable treatment for the relief of his patient; but, as it is, much must be left, in every instance, to the experience and judgment of the practitioner. In general, however, it may be observed that all such wounds are fraught with danger, both to limb and life, when they are attended with extensive laceration of the soft parts; when the muscles have been horribly bruised and pulpified, important nerves cut across, the principal arteries, or arteries and veins torn open; large joints penetrated, and the bones broken in pieces. Under such circumstances there is not even a "forlorn hope," no matter what may have been the previous health and habits of the sufferer; the knife is required, and the sooner it is employed the better. Such cases are absolutely desperate, and no one who has any knowledge of consequences can hesitate as to the course to be pursued. Upon this point there is no discrepancy of opinion whatever among surgeons. But the injury may be of a less severe character, involving, perhaps, merely a considerable contusion of the soft structures with a compound fracture; or several muscles may be badly lacerated and the principal artery of a limb cut across; or a large nerve, the main trunk, it may be, has been divided, and the interior of a large joint exposed. The case now assumes a more trying aspect; the responsibility falls upon the surgeon with tenfold force; for the question naturally, and at once arises, what shall be done? Shall such a limb be immediately amputated, or shall an attempt be made to preserve it? This is a question which will probably be asked by the patient himself, or by his friends for him, and which it is often extremely embarrassing and difficult to answer; in fact, it can only be answered upon general principles in one sense, and upon special principles in another. Looking at such injuries in a general manner, we might be inclined to give a favorable prognosis; because it is undoubtedly true that recovery from such lesions is by no means uncommon; but when we come to examine into the particulars of the case, we might not regard it in so auspicious a light. Thus, for example, the patient's antecedents may all have been bad, perhaps of the worst possible description; intemperance and dissipation of various kinds may have undermined his constitution, and thus rendered it unfit to bear up under an injury which he would formerly have supported without difficulty; or, instead of this, there may be serious structural disease of some vital organ, as the heart, stomach, or lungs, disqualifying him for enduring the accidental and now heavy burden. All these circumstances must have their weight with the practitioner when he is called upon to sit in judgment respecting the propriety or impropriety of an amputation. Conservative surgery may, and does do much, but it cannot do every-

thing; it has its limits, beyond which it cannot safely go, and there are many points which require to be considered in order that it may do itself justice. A very severe injury, occurring in a stout youth, of healthy constitution and temperate habits, is often promptly recovered from, while less than one-third of its amount in a sickly, anemic, or dissipated person, will frequently destroy life in a few days, or, at all events, so far endanger it as to cause great anxiety for the result.

Gunshot, railroad, and steamboat accidents, and injuries occasioned by the caving in of stone quarries, are extremely liable, if an attempt be made to save the limb, to be followed by the worst results; and, what is particularly embarrassing in these cases, is the difficulty which the practitioner often encounters in ascertaining the precise amount of the lesion. The limb, perhaps, is entirely free from contusion and wound, or if there be any injury of this kind, it may be so slight as to be regarded as of no consequence. The mischief is deep-seated, and, upon careful examination, it will probably be found to involve nearly every important structure; muscle, tendon, aponeurosis, vessel, nerve, bone, and joint. Such cases obviously require the closest scrutiny with a view to the speedy detection of their true nature and their proper mode of management. Generally the limb is hopelessly injured, and will require removal.

Compound fractures and dislocations, and gunshot wounds of the joints, often require amputation, and yet it is remarkable how the parts and system sometimes bear up under such injuries, especially in young and healthy subjects. Under the improved methods of management of modern surgery recoveries occasionally occur, which, in former times, when their treatment was less perfectly understood than it is now, would have astonished the practitioner. In this country the treatment of compound fractures and dislocations by collodion, thereby converting these lesions into simple accidents, and of the former by extending and counter-extending bands of adhesive plaster, has greatly contributed to this result. The danger of these injuries is much greater, other things being equal, when they occur in the inferior extremity than when they occur in the arm and forearm, and in all cases the risk is much increased when they are accompanied by an open state of an important articulation, as that of the hip, knee, ankle, shoulder, elbow, or wrist. Compound fractures in the continuity of a limb, unless complicated with serious lesion of the soft structures, do not generally require amputation; if judiciously managed, they will usually get well without much trouble. Gunshot wounds, occurring in civil practice, are commonly less dangerous than injuries of this kind happening on the field of battle or on ship-board. I have seen enough of the former of these accidents to satisfy me that the patient will often recover with a very good limb, even when there has been extensive loss of substance and great comminution of the bones. In military practice, on the contrary, there will often be much difficulty in preserving the parts, simply because it is frequently impossible to treat the case properly on account of the want of suitable accommodations and a salubrious atmosphere. It is for these reasons that amputation

is so often resorted to, during and after engagements, in cases which, if they took place under ordinary circumstances, would be successfully managed by milder means.

When amputation is determined upon, in these and similar accidents, the next question that arises is, when should the operation be executed? Shall it be performed immediately, or shall we wait until some time has elapsed, until the system has had an opportunity of recovering from the shock of the injury? To use the knife while the patient is in an exhausted, pallid, and perhaps almost pulseless condition, would only serve the more certainly and effectually to seal his fate; the additional shock to the constitution resulting from the loss of blood and nervous fluid could hardly fail to prove most disastrous. Hence the rule is always to postpone a resort to the knife until there is satisfactory evidence of reaction; until, in short, warmth and color return to the surface, the pulse beats vigorously at the wrist, and the sufferer regains, in some degree, his consciousness and courage. Now the use of chloroform is well borne, and the limb is removed with comparative impunity. On the other hand, care is taken not to defer the operation until the part and system are assailed by inflammation, which, as experience teaches, often extends with frightful rapidity under such circumstances, placing the case, perhaps, literally beyond the resources of surgery in the course of a few hours. There is, therefore, a time when interference must be avoided, not less than a time when it must be courted. The limits of these two periods are not always well defined, and hence much must be left, in each individual case, to the judgment of the attendant.

When amputation is performed immediately after reaction has taken place, it is usually designated by the prefix "primary," while the term "secondary" is used to denote the operation when it is executed after the limb has passed through the different stages of inflammation, an attempt having been made, perhaps well grounded, so far as the interpretation of the symptoms is concerned, to save the parts. Such a contingency must necessarily happen rather frequently, especially in civil practice; indeed it is often altogether unavoidable on account of the obstacles interposed by the patient and his friends, not to say anything of the wavering and indecision of the professional attendant. But, although often unavoidable, such an occurrence is always much to be regretted; for if the chances of saving limb and life were bad in the first instance, they are now generally much worse; the system has been impaired by fever and perhaps hectic irritation, the secretions are seriously deranged, the patient has little appetite and sleep, the blood is thin and watery, and the whole body is much emaciated. Life may possibly still be preserved, but the probability is that the operation will be attended with much risk, and that ultimate recovery is far off. Moreover, a much larger amount of limb may now have to be sacrificed; originally a foot might have sufficed, whereas now, in consequence of the ravages of the inflammation, the whole leg may perhaps require removal. There is, then, obviously an advantage in a primary over a secondary amputation, provided it is performed at the proper time, that is, after the establishment of reaction and before

the occurrence of inflammation; and this circumstance is often eagerly embraced by the military surgeon, whose will is always law with his patients.

3. *Morbid Growths.*—Amputation is sometimes required on account of morbid growths, or tumors, both benign and malignant. The removal of the forearm is perfectly proper for the cure of carcinoma of the hand, and of the arm at the shoulder for a similar affection of the humerus. No such operation is of course admissible if there is marked constitutional involvement, enlargement of the neighboring lymphatic ganglions, or decided tendency to ulceration; the propitious period has gone by, and interference would only hasten the fatal event. It is not so, however, as long as the general health remains good, and there is no evidence of general or local contamination; under such circumstances the probability is strong that removal of the limb, although it may not prevent a recurrence of the disease, will yet considerably prolong the patient's life.

A tumor, wholly divested of malignancy, may, in consequence of acting obstructingly, cause so much functional and other disturbance as to demand removal of the limb upon which it is situated. The procedure will be particularly called for when the morbid growth is intimately connected with a bone, or deeply and inseparably involved in the soft parts, or prolonged into an important joint, compelling free exposure of its surfaces during the operation. A valuable rule in tumors is to excise the benign, and to get rid of the malignant by amputation.

4. *Aneurism.*—Neglected aneurisms, seated in the extremities, and unamenable to ordinary treatment, occasionally call for the removal of the limb; in former times, such operations were sufficiently frequent when the disease occupied the popliteal region, though at present they are seldom, if ever, required, except when mortification sets in after ligation of the femoral artery, or in consequence of the injurious compression exerted by the tumor upon the leg.

5. *Affections of Bones and Joints.*—Various affections of the bones and joints, as caries, necrosis, morbid growths, aneurism, and anchylosis, may impose the necessity of amputation; and there is, according to my experience, no class of diseases in which the operation has been more frequently abused, or misapplied. There can be no question that many a limb, merely temporarily crippled by remediable disease, has been ruthlessly sacrificed to ignorance and a desire for éclat; carious joints, now that excision has been revived, can seldom demand so harsh a procedure, and, as to necrosis, pure and uncomplicated, it is difficult to conceive of a case justifying the use of the knife. It is only, or mainly, in white swelling, or scrofulous disease of the knee, ankle, and elbow, attended with hectic irritation, excessive pain, and exhausting diarrhœa, that the removal of the limb can be proper, and even then it should not be thought of if it be possible to exsect the affected structures without imperilling life by shock and loss of blood. In whatever manner the offending parts are gotten rid of, it is surprising to witness the great improvement which usually follows the operation; the profuse sweats and alvine discharges rapidly disappear,

the appetite improves, the sleep becomes refreshing, and the patient soon regains his flesh and strength. Unfortunately, the operation is generally put off to an unreasonable period, so that when it is at length performed, the sufferer too frequently sinks under its effects.

Of malignant growths of the bones almost the only one demanding amputation of the limbs is encephaloid; scirrhus, melanosis, and colloid are extremely infrequent in the osseous tissue, but whenever they occur, and their diagnosis can be determined, the same treatment must be applied to them as to medullary cancer; that is, early and thorough removal by the sacrifice of the suffering extremity, mere incision being always inadequate by reason of the involvement of the soft parts. Temporary relief only is aimed at; sooner or later the disease recurs, either at the cicatrice, or in some neighboring organ, and carries off the patient.

Fibrous, fibro-plastic, cartilaginous, and osseous growths, involving the bones, sometimes constitute a legitimate ground for amputation. An exostosis, of enormous size, and grotesque form, may render an extremity not only perfectly useless, but a source of the greatest inconvenience and even suffering. The so-called osteo-sarcomatous tumors are, perhaps, of all the morbid growths of the skeleton, the most common causes of amputation of the limbs. Aneurismal formations of the osseous tissue, met with chiefly in the head of the tibia, always demand the same remedy.

Finally, amputation may be required on account of anchylosis of a joint, interfering with the comfort and usefulness of the extremity. Thus, in anchylosis of the knee, the leg may stand off at a right angle with the thigh, so as to interfere materially with the occupation of the individual, and induce a wish for an artificial limb, which, if well constructed, is generally worn with great satisfaction. Stiff and crooked fingers and toes are often the subjects of amputation.

6. *Ulcers.*—Amputation is sometimes performed on account of old and inveterate ulcers of the extremities; the operation, however, is less frequently resorted to now than formerly, and might, with proper management, be almost entirely dispensed with. Unless the sore is of a cancerous character, or caused by burns, scalds, and frost-bites, or complicated with serious lesion of the bones, excessive enlargement of the veins, or great hypertrophy of the integuments, there are few cases, it seems to me, that will not gradually yield under judicious treatment. Of the numerous ulcers of the extremities that have fallen under my observation, embracing, of course, many of the worst description, I have a distinct recollection of only three that required this harsh measure. Whether other practitioners have been equally fortunate I am not able to state; but, judging from the reports of cases in our periodicals, I am induced to believe that the operation is still not unfrequently performed on this account.

7. *Malformations.*—There are certain malformations and deformities for the relief of which amputation may be demanded. An irremediable club-foot, especially if complicated with a painful bunion, an intractable ulcer, or excessive atrophy of the leg, would form a proper subject for such an operation; for there are few men who would not

rather run the risk attending its performance than to be incessantly fretted and worried by such a disagreeable and useless companion. Supernumerary thumbs and fingers are disposed of in the same manner; the operation is usually done within a few months after birth, and I have never known it to be followed by any bad consequences. Amputation is occasionally necessary on account of deformity caused by burns and scalds, or badly treated fractures and luxations.

8. *Tetanus.*—The propriety of amputating in tetanus has been so long doubted by many of the highest authorities in surgery that the question hardly merits serious consideration in a work of this kind. I have certainly not seen anything in my own practice tending to contradict an opinion now almost universally entertained by the profession in this and other countries. If such a measure is ever justifiable, it must be at the very commencement of the disease, before the supervention of the characteristic symptoms. I have seen a very considerable number of cases of acute traumatic tetanus, and, with one solitary exception, they have all proved fatal. This case occurred in a stout, well-fed countryman, aged fifty years, the fore and middle fingers of whose right hand had been badly mashed by the passage of the wheel of a wagon; symptoms of tetanus came on five weeks after the accident, and, although the disease had existed for five days when I amputated at the metacarpo-phalangeal articulations, yet complete recovery followed, not, however, without a slight continuance of the spasms for a short time after. I presume a practitioner would hesitate to cut off a large limb after the development of tetanus in any case; for, whatever notions we may entertain respecting the pathology of this affection, there can be no doubt that, once fully established, it must be looked upon as a constitutional disorder in the widest sense of that term.

SECT. III.—METHODS OF AMPUTATION.

Two principal methods are in vogue for performing amputation of the limbs, whether in their continuity or at the joints. These are the circular and the flap, both of which, but especially the former, are of ancient date, and therefore well grounded in the esteem of the profession. To these was added, early in the present century, the oval operation, which, although excellent in its way, has hitherto received but little attention; certainly less than it deserves. Very recently, an operation, termed the rectangular, has been proposed. It is not my object to enter into the history of these different methods, for to do so would carry me back into the regions of doubt and speculation; but it will be expected that I should offer some remarks concerning their respective advantages and disadvantages, and this I shall endeavor to do in as concise and impartial a manner as may be consistent with the great interest and importance of the subject.

1. *Circular Method.*—The circular operation, the most ancient of all, was originally performed in the most simple manner, the integuments, muscles, and bones being all divided upon the same level. The con-

sequence of this procedure was that the bones, being inadequately covered by the soft parts, or, rather, not covered at all, invariably perished to the distance of several inches, thus sadly protracting the cure, besides subjecting the patient to much suffering and not a little risk in the interval. As surgeons became more enlightened, they endeavored to provide against this contingency by forcibly pulling back the muscles, by means of a peculiar contrivance called a retractor, before using the saw, which was then applied close to the surface of the tissues. At a later period still, and as a decided improvement upon the preceding methods, arose the plan of double incision, devised by Cheselden, better known for his success as a lithotomist than for his exploits as a general operator. It consisted, as, indeed, the name sufficiently indicates, of two stages, in the first of which the integuments were cut and drawn back, while in the second the muscles were divided higher up, the object being to afford more thorough protection to the bone. The operation of the English surgeon has undergone various modifications, some of which, having only served to render it more complex, have been justly discarded from practice. To this category belong the division of the muscles by two circular incisions, one higher up than the other; and the plan of scooping out the parts as the knife was being swept obliquely around them by cutting from below upwards and from without inwards towards the bone, which thus formed the apex of the hollow cone.

The circular operation, as now generally practised, consists, first, in dividing the common integuments, dissecting them from the parts beneath, to a variable extent, and then drawing them back, or even turning them up like the cuff of a coat; secondly, in cutting through the muscles on a level with the retracted skin, and after detaching them for some distance from the bone, to hold them also forcibly back; and, thirdly, in sawing off the bone as high up as possible without doing violence to the soft structures. In executing these several stages of the proceeding the long amputating knife, poised lightly between the thumb and fingers, is carried rapidly round the limb, the point being inserted into its anterior surface, external to the median line, and thence drawn towards the operator in such a manner that the heel of the instrument shall finish the incision. The wound thus made extends simply down to the aponeurosis, and care should be taken that it occupies the same level throughout, unless there be special reasons for carrying it higher or lower at one point than at another, rendered necessary, it may be, by the presence of a vicious cicatrice, ulceration, gangrene, or some morbid growth. The flap is then rapidly dissected up either with the same instrument, or a large scalpel, and held out of the way, its length being regulated by the thickness of the limb, about two inches being a good average. The amputating knife being now resumed, and held as before, is applied closely to the edge of the retracted integuments, and then drawn round the member so as to divide all the muscles down to the bone. This part of the operation is usually the work of a few seconds. The next step is to separate the muscles carefully from their connection to the bone, to the distance of at least an inch and a half, if not more, when, being

pressed forcibly back by means of a retractor, the bone is sawn off close to their surface. The adjoining cuts (figs. 122 and 123), afford a good illustration of the appearances of the limb, both above and below the stump, after this operation.

Fig. 122.

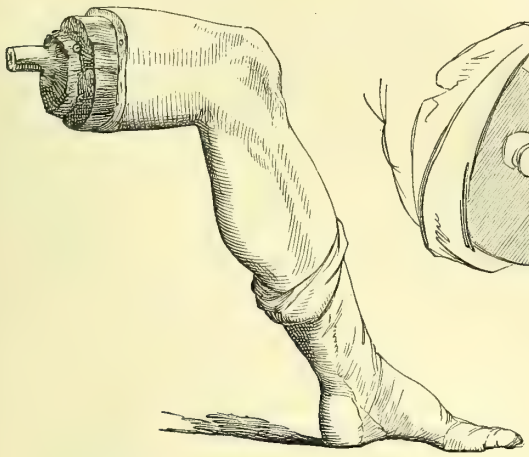
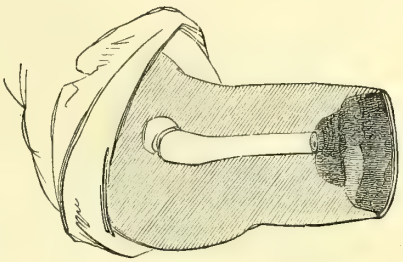


Fig. 123.



In sawing the bone, whether in this or in the flap operation, it is an object of primary importance to inflict as little injury as possible upon the periosteum; for the less the integrity of this membrane is disturbed the less likelihood will there be of necrosis and other bad consequences. When the periosteum is very thick, as in thigh bone, it would be well, in view of this circumstance, to make a circular track in it for the saw, in order that there may be no risk of laceration. The manner of dividing the bone is a matter of some moment. In most of the amputations that I have witnessed the instrument was applied against the front of the bone, instead of being held perpendicularly so as to divide the bone from side to side, as it generally should be to avoid fracture, which is so liable to happen if proper care be not taken to support the limb in this stage of the procedure. Particular rules are usually laid down by authors for working the saw. Thus, it is generally stated that the heel of the instrument alone should be used until a track is made for it to move in; but I consider all such directions to be unnecessary, if not frivolous. If the saw is properly set it is of little consequence, according to my experience, what part is applied first or last, or whether it be moved rapidly or slowly, although, as a matter of choice, I should prefer to finish the operation as quickly as possible. When there are two bones of equal size to be cut, as in amputations of the forearm, they should be divided simultaneously; but if one is thicker than the other, as in the leg, the weaker must always be separated first, lest, if it should remain until the other is sawn through, it should be broken or splintered, and so impose the necessity of employing the nippers to smooth off its extremity.

2. *Flap Method.*—Although the flap operation was described, and no doubt practised, by some of the earlier surgeons, yet it does not seem to have received any particular attention until towards the close of the seventeenth century, when Lowdham, of Oxford, England, published a short tract upon it, setting forth its advantages over the circular method. After this period, it was occasionally performed in different parts of Europe, especially in France and England, but it never fully acquired the confidence of the profession until the time of Mr. Liston, whose teachings and writings brought it into general notice.

There are several methods of forming the flaps, the choice of which must be regulated by the particular circumstances of each individual case. Thus, the operation may be performed by transfixion of the limb, and cutting from within outwards, by commencing at the surface, and carrying the knife inwards towards the bone, or, lastly, by making one of the flaps after the former fashion, and the other after the latter. In amputations of the thigh and arm, it is customary to make both flaps by transfixion, as the operation is thus greatly simplified and rendered more expeditious; but in the forearm, hand, fingers, leg, foot, and toes, they are formed either by cutting inwards, or one by cutting inwards and the other by cutting outwards. The number of flaps varies; in general there are two, but occasionally there is only one, and, on the other hand, there may be as many as three; accident, or the situation and structure of the limb, rendering one of these modes preferable to the other. Thus, in one instance, I amputated the thigh at its middle by a solitary flap, and succeeded in effecting an excellent cure. The military surgeon is often compelled to form his flaps as best he can, owing to the manner in which the soft parts are injured, and in civil practice the same difficulty sometimes occurs in consequence of the effects of disease. Whatever may be the nature of the case, the rule is never to include any unsound tissues or any portion of bone that is fractured or divested of periosteum. In amputating the thigh and arm at their middle, the flaps are generally cut of the same length; but in most other situations one is usually made considerably longer than the other, depending upon the greater amount of muscular substance. Their relative length must be regulated by the thickness of the limb, and the quantity, laxity, and contractility of the soft parts. It is better, in every case, to have too much substance than too little, but the judicious surgeon will always endeavor so to cut his flaps as to have just enough, and no more, to form a well-shaped and useful stump, redundancy being always unseemly, if not actually in the way of comfort and convenience. As a general rule, their length should equal about three-fourths of the diameter of the limb, being invariably greater than in a similar operation upon the dead subject, to allow for contraction and shrinkage. The form of the body of the flaps is commonly somewhat convex, while the extremity is more or less oblique, care being taken that they do not terminate in thin, narrow ends, and that there is always an abundance of integument after they are adjusted over the bone. When the muscular tissue is unusually abundant, as often happens in amputating through the calf of the leg, I have found it advisable to retrench it with the knife, in

order to give the stump a more seemly shape, as well as to place it in a better condition for bearing the pressure of an artificial limb.

In performing the operation the same general rules are to be observed as in the circular method; hemorrhage is restrained by the same means, and the skin is drawn back by the hands of an assistant, who also retracts the flaps as one after the other is made, and thus holds them out of the way of the knife and saw. Any important vessels that may be bleeding are instantly compressed by the fingers until they can be tied. Before applying the saw the knife is pressed closely around the bone so as to divide every muscular fibre, and also, if possible, the periosteum. The most suitable instrument for removing the larger limbs is a long amputating knife; for the smaller ones, an ordinary scalpel, bistoury, or catlin will answer best. Separation of the member having been effected, and the vessels carefully secured, the next thing to be done is to cut off the principal nervous trunks a little above the level of the surface of the stump, and as the operation is one of excessive pain, it should always be performed before the patient has fully recovered from the influence of chloroform. I need not dwell upon the importance of thus dealing with the nerves involved in the flaps; the necessity of the procedure must be obvious upon the slightest reflection. When it is considered that they always become more or less enlarged and bulbous after all operations of this kind, it is easy to perceive what would be the consequence if they were brought in contact, as some of them almost inevitably would be, with the extremity of the bone, before it has had time to become rounded off. I regard no amputation by the flap method as being finished unless provision has been made against such a contingency. The adjoining cuts (figs. 124 and 125) represent the appearances of the stump and of the limb after its removal.

Fig. 124.

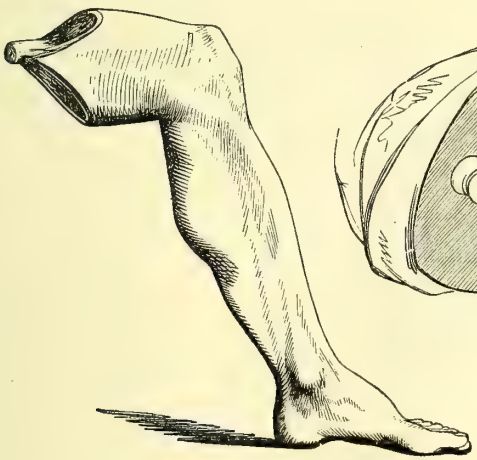


Fig. 124. The flap operation illustrated in the thigh. The sloping wounds, whence the flaps have been taken, shown in the amputated part.

Fig. 125.

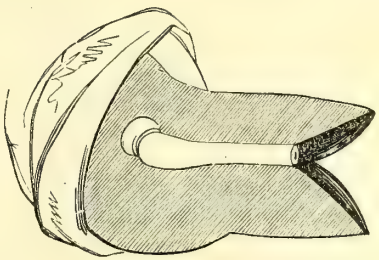


Fig. 125. The corresponding stump; intended to exhibit the comparatively small extent of wound that remains.

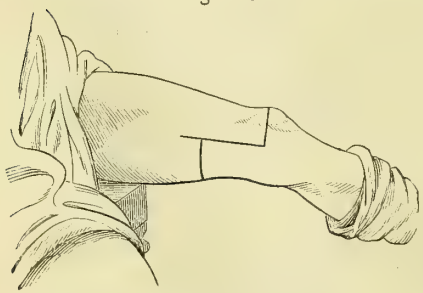
3. *Oval Method.*—In the oval method, as it is termed by Scoutteten, by whom it has been generalized, or the oblique process, as it has been called by others, the wound has somewhat of the shape of an ovoid, the small extremity of which corresponds to the bone or joint which is the seat of the amputation. The operation holds a kind of intermediate position between the other two, resembling the circular process in the mode of incising the soft parts, and the flap in the form of the wound. It is more especially adapted to amputations of the joints, particularly the smaller, as, for example, the metacarpo-phalangeal, but has also been applied to the joints of the hip and shoulder, especially by Guthrie, Larrey, and Scoutteten, who have devised plans which severally bear their names.

In the oval operation the flaps are formed by cutting from without inwards, or one is formed in this way and the other by cutting in the opposite direction, or from within outwards. It is commenced by making two incisions in the shape of the letter V reversed, the angle of union falling a little above the place where it is intended to saw the bone or effect disarticulation. These incisions are, of course, extended as far as the periosteum, when the knife, drawn closely round behind the bone, is carried downwards on a level with the termination of the two cuts already made, thus connecting them by one thrust, as the instrument sweeps through the intervening tissues. By adopting this plan of procedure the surgeon will have it in his power to leave the principal vessels and nerves until the operation is nearly completed, a circumstance which thus affords him a much better control over the hemorrhage.

The oval operation usually makes an excellent stump, there being always an abundance of material for covering the bone; it is generally a little more tedious than the flap amputation, but this should not be urged as an objection to it, as in all other respects the result is most satisfactory.

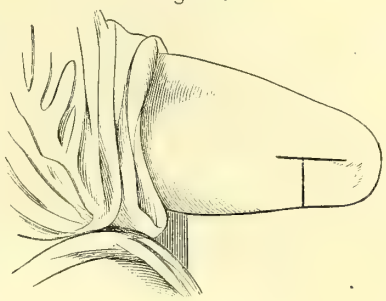
4. *Rectangular Flap.*—Mr. Teale, of Leeds, has recently modified the double flap operation by substituting a long and short rectangular flap. The long flap should be made from the portion of the limb which does not contain important bloodvessels and nerves, these being included in the short one. Before proceeding to the operation, the lines of the incision should be traced with ink, in order to insure the proper dimensions of the large flap, which should be equal, in its length and breadth, to one-half the circumference of the limb at the point amputated. The short flap, which should be made last, should be one-fourth the length of the long one. The lines of incision and the length of the flaps will be more easily understood from the annexed cut (fig. 126), representing an amputation of the thigh. The parts having been dis-

Fig. 126.



sected off, in close contact with the periosteum, the long flap will be found to be perfectly square, and to contain a sufficient amount of movable soft parts to form a complete cushion for the end of the bone, which must be sawn off perfectly straight, and must be free from spicula, in order to prevent ulceration of the soft structures. The arteries having been taken up, the long flap is brought down over the end of the bone, and attached to the short one by several points of the interrupted suture. The short flap is also attached to the long flap laterally, as is also the reflected portion of the long flap to its unreflected portion. The appearances of the parts, when brought together, are shown in fig. 127.

Fig. 127.



Beside the sutures no other dressings are employed. The stump is placed on a pillow covered with a sheet of gutta percha, and is protected by a wire cage from the pressure of the bedclothes. Should the wound gap during the process of union, a few adhesive strips may be applied, to give the flaps proper support. Absolute rest is enjoined; and the stump should not be disturbed, the discharges being removed from the parts and the gutta percha cloth by a soft sponge.

Mr. Teale publishes a summary of fifty-six cases treated by his method during the last three years. Of these, the whole number of deaths was seven, or in the proportion of one to eight. Eighteen operations were performed on the thigh, twenty-eight on the leg, six on the arm, and four on the forearm. Of this whole number, only six cases were of traumatic origin, and of these but one resulted in death. This shows a great contrast with seventeen traumatic operations at the Leeds General Infirmary, by the same surgeons, of which ten died, seven from the effects of purulent infection. Amputation of the thigh for disease by this method exhibits a mortality of nearly one case in six, whilst in the London hospitals it is as one in four and a half, and in the provincial hospitals, as one in four.

The rate of mortality in amputations of the leg for disease is one in twenty-seven. In the London hospitals it is one in three and two-thirds, and in the provincial hospitals one in four. Mr. Teale, after carefully analyzing 640 amputations of the thigh and leg, for disease or injury performed by the ordinary methods in the London and provincial hospitals, found the mortality to be nearly one in three. In forty-six amputations of the thigh and leg by the rectangular flap, for injury or disease, the fatality is one in fourteen, showing a most striking contrast with the above facts.

SECT. IV.—OPERATION AND AFTER-TREATMENT.

The position of the patient and the surgeon, the number and duties of the assistants, and the character of the instruments, must necessarily vary in different cases and under different circumstances, and can therefore be pointed out here only in a general manner.

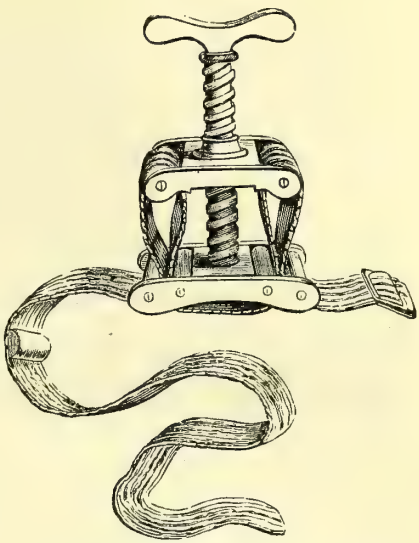
Whenever it is practicable, the patient should be placed recumbent, as he will thus be much less liable to become faint, and at the same time bear the effects of chloroform much better than when he sits up. He may, however, put himself in the latter position without any inconvenience during the amputation of a finger or toe, or even of the arm or leg, if he is courageous, and willing to dispense with chloroform, or to take ether in its stead. The limb is generally held horizontally, away from the table, one assistant retracting the integuments, and another supporting the portion to be removed. A third assistant takes charge of the tourniquet, but before applying it care is taken to empty the superficial veins by raising the limb and pressing it from above downwards; or, instead of this, the extremity is tightly bandaged just before the operation. Such a precaution, however, is only of material moment when the patient is very feeble, and therefore ill able to bear the loss of blood. Chloroform having been administered, the instrument is firmly secured round the limb, the frame resting upon a thick, narrow compress, lying directly over the main artery, and when all pulsation is arrested, the operation is proceeded with in as rapid, orderly, and careful a manner as possible. When the amputation is performed high up near the trunk, the tourniquet may advantageously be replaced by the compression of the hands of an assistant, who trusts either to his thumbs alone, or else makes the requisite pressure by means of the handle of a stout key, wrapped round with a piece of muslin. The same plan for restraining hemorrhage is adopted in amputating at the hip and shoulder joints. In separating a large limb, not less than five assistants are generally necessary; one for administering chloroform, a second to take charge of the tourniquet, a third to hold up the flaps, one to support the distal portion of the member, and a fifth to hand the instruments and sponges, and aid in securing the arteries. A small number will of course suffice when we remove a finger or other insignificant part.

The different methods of amputation are described in the preceding section. The one which I prefer is that by flap, though it cannot be denied that a most excellent stump may be made by the circular operation. The rectangular method I have never performed, but it seems to me to be a procedure well worthy of attention, as the arrangement of the long flap not only thoroughly protects the bone, but, what is a matter of great consequence, admits of ready drainage. The oval operation is admirably adapted to amputations at the joints and to resections of the bones.

My reasons for preferring the flap to the circular operation, are, first, because it is more simple and easy of execution; secondly, because it

makes, as a general rule, a much better covering for the bone; and, lastly, because the patient experiences much greater comfort in wearing an artificial limb. Mr. Palmer, who has for many years been engaged in the manufacture of artificial legs, assures me that stumps made by the circular operation, seldom answer well for the adaptation of an artificial substitute.

Fig. 128.

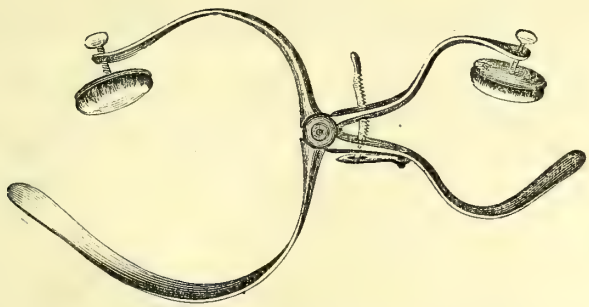


The tourniquet unapplied; but with its two platforms as much separated, as if in actual use.

The principal instruments required for the operation are, for the larger limbs, a tourniquet, an amputating knife, a catlin, saw, and pliers, which are properly arranged upon a tray in the order in which they will be needed. For removing the fingers, hand, toes, and foot, an ordinary scalpel will commonly suffice. The tourniquet in general use is that of Petit, the construction and arrangement of which may be readily learned from the annexed sketch (fig. 128), a circumstance which, besides the fact that it is found in every cutler's shop, will render any formal description of it unnecessary.

Fig. 129 represents an arterial *compressor* which I devised several years ago, as a convenient substitute for the ordinary tourniquet, over which, I conceive, it possesses several decided advantages; first, in the

Fig. 129.



facility of its application; secondly, in the amount of pressure which it is capable of exerting; thirdly, in its ready adaptation to limbs of different dimensions; fourthly, in the circumstance that it makes pressure only at two points, that is, over the artery, and at the spot immediately opposite to the artery; and, lastly, the facility with which it may be

slackened or removed at any stage of the operation. With a little modification, the instrument may readily be adapted to the femoral artery as it emerges from beneath Poupart's ligament, or even to the external iliac just above this ligament, in amputation at the hip-joint, and also to the axillary artery, in disarticulation of the shoulder-joint.

By a reference to the cut, it will be seen that the instrument is composed of two blades, differing in the degree of their curvatures, united by a screw, and regulated by a rachet. Each short blade is provided with a pad, capable of being worked by a screw, and designed to rest upon the artery which it is intended to compress. By this arrangement two tourniquets are produced: a large one for the thigh, and a small one for the arm, or the thigh of a small subject.

The ordinary amputating knife (fig. 130) is from nine to twelve inches in length, by about five lines in width, with a moderately thick back, spear-pointed, and furnished with a stout, rough, ebony

Fig. 130.



handle, to prevent it from dropping out of the hand if it should become smeared with blood. The principal edge should extend the whole length of the blade, and be in the best possible condition for executing its important office; well tempered, and perfectly sharp. The edge upon the back should not be longer than an inch and a half. With such an instrument, properly managed, nearly all the amputations in the body may be performed with great neatness and despatch. The catlin (fig. 131) is a double-edged knife, used principally in removing the forearm and leg, for dividing the interosseous muscles and ligaments;

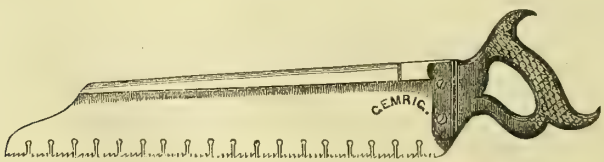
Fig. 131.



I cannot see, however, that it possesses any special advantage, even in these cases, over the larger knife just described.

Every amputating case contains a large saw, resembling the com-

Fig. 132.



mon dove-tail saw of the cabinet-maker. The adjoining sketch (fig. 132) represents the form of the instrument which I am myself in the

habit of using. The blade, which is very firm, is ten inches and a half in length at the cutting edge, by two inches and one-eighth in breadth, exclusive of the back, which is very thick and convex, in order to afford the proper degree of strength which such an implement should always possess. The handle is rough, and sufficiently large to receive two fingers, while the thumb and forefinger are applied to its surfaces, parallel with the upper border, to keep it steady while engaged in the discharge of its duty. The teeth are rather large but sharp, set crossways on the edge, that the instrument may not hang or hitch as it works its way through the bone. The manner of using the saw has already been described.

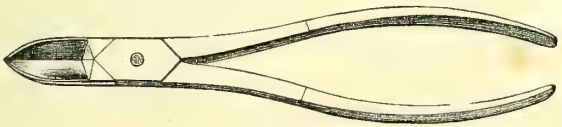
A small saw, such as is represented in the annexed cut (fig. 133), will be of great service in amputations of the hand and foot.

Fig. 133.



Cutting-pliers (fig. 134), of various sizes and forms, must be at hand; they should be short but rather slender in the blades, and very long and strong in the handle. Although I never use these instruments when it is possible to employ the saw, on account of their tendency to

Fig. 134.



bruise the osseous tissue, yet they are of great convenience for removing sharp spicula, and cutting off certain pieces of the skeleton, as the phalanges of the toes and fingers, the ribs, and jaws.

As it respects the permanent *dressings* after amputation, they should be of the lightest and most simple character. In the larger operations they should not, as a general rule, be applied before the lapse of four or five hours, by which time the surfaces of the wound will usually be glazed with lymph, and all danger of hemorrhage be past. I can conceive of nothing more awkward for the surgeon or disagreeable to the patient, than the necessity of undoing the dressings, some hours after the removal of a limb, for the purpose of searching for bleeding vessels. Such a procedure is sure to cause alarm and suffering; and, although it is always desirable to complete the dressings as early as possible in ordinary cases, yet after a large amputation, involving huge and numerous muscles liable to conceal considerable-sized arteries, I regard it as a matter of great consequence not to hazard the necessity of their removal. During the period that intervenes between the operation and the permanent dressings, the limb should be placed in an easy and elevated position, and the flaps should either be loosely

approximated with a few adhesive strips, or, what is better, left apart, and covered with light compresses wet with cold water, and frequently irrigated; not changed, unless soaked with blood, as this would only lead to exposure and irritation of the parts.

All bleeding and danger of bleeding having ceased, the flaps are carefully stitched in place, the ligatures are brought out at the nearest points, and the intervals between the sutures are covered with long and rather narrow strips of plaster, to admit of sufficient drainage. This should be still further favored, when the breach is very large and deep, by the insertion of a slender tent in the lower angle of the wound, and strict attention to the position of the stump. To a want of these precautions are unquestionably to be ascribed some of the bad effects of these operations, as pyemia, profuse suppuration, and the death of the extremity of the bone. The wound being firmly closed at all points, the matter, of which there is nearly always more or less after all large amputations, accumulates in the depths of the stump, around the bone, and among the muscles, thus causing necrosis of the former, and affording the veins and lymphatics of the latter an opportunity of conveying the fluid into the system, and thereby inducing secondary abscesses. Now, all this risk may be effectually prevented by adopting the plan here suggested of keeping a long, slender, and well-oiled tent in the lower part of the wound for the first thirty-six or forty-eight hours; at the end of this time it may be carefully removed, and any pus that may be present gently pressed out. A gum-elastic tube may now, if necessary, take the place of the tent, with a view to a more ready and steady drainage; or, if the suppurative crisis is passed, the foreign body may be dispensed with, and the case managed in the ordinary way.

The adhesive strips must, if possible, extend four or five inches beyond the upper extremity of each flap, especially in the larger amputations, so as to prevent the retraction of the integuments; and for the purpose also of quieting the muscles and bringing them well forward over the bone. I have been in the habit for many years of beginning the application of the roller at the part of the limb nearest the trunk, carrying it firmly and equably downward to the very verge of the stump, which is then enveloped by a few crucial turns of the bandage, to give it greater support. No other dressing is necessary. The limb is now placed in an easy and slightly elevated position, over a sheet of gutta percha, and kept constantly wet with cold water, applied by means of a light porous napkin, substitution being employed only in the event of the cloth becoming bloody or offensive. If suppuration be threatened, or the cold is disagreeable and chilling in its effects, the most eligible remedy will be an emollient cataplasm or the warm water-dressing. Provision is of course made to protect the stump from the contact of the bedclothes. As soon as the operation is over, a full anodyne is ordered, for the twofold purpose of relieving pain and preventing spasm; and the dose is afterwards repeated from time to time as circumstances may seem to demand its exhibition. The diet should be light but rather nourishing than otherwise; and, with the exception of a mild aperient on the second day, no medicine

whatever should be given unless it is absolutely necessary on account of the violence of the traumatic fever, or the danger of exhaustion from shock and hemorrhage. When the system is much depressed at the time of the operation, it will be well, as a general rule, to put the patient at once upon a generous diet, and perhaps even upon the use of milk punch. I am satisfied, from what I have seen of these cases, that the worst possible plan that can be pursued is starvation; this not only weakens the system still farther but tends powerfully to the production of pyemia and typhoid fever.

The dressings may require removal within forty-eight hours after the operation, or not under three or four days, according to the condition of the parts. When the adhesive action is progressing favorably the less interference there is the better; any discharge that may collect upon the surface of the stump may be easily soaked up with a soft sponge. If considerable swelling and pain take place, or profuse suppuration set in, the change cannot be effected too soon; and it need hardly be added, that, while it is being made, the stump should be well supported by an assistant, and that all pressure and unnecessary manipulation should be avoided. Any tendency to bagging that may show itself is to be counteracted by the judicious application of the adhesive strips and bandage. The sutures should not be cut out too soon; as long as they are affording support they should be permitted to remain.

After the wound has healed, the stump should be protected for some time with a piece of soft flannel, to prevent the ill effects that might otherwise arise from atmospheric vicissitudes; and all pressure upon its surface should be carefully avoided until the parts have regained their natural sensibility.

SYNCHRONOUS AMPUTATION.

In cases of accident, as well as in certain diseases, but especially in the former, it occasionally becomes necessary to amputate two limbs simultaneously, or in immediate succession, the circumstances which call for the removal of the one demanding the separation of the other. This constitutes what is termed the synchronous double operation. It is founded upon the assumption that the recovery is more rapid when two limbs are cut off simultaneously than at two separate and distinct periods; that the loss of blood will be comparatively little more from two amputations thus performed than from one alone; that there will be, in the aggregate, much less pain, shock, and inconvenience; and, lastly, that the patient will thus escape the harassing anxiety of mind growing out of the knowledge that he will be obliged to submit to another operation. Synchronous double amputation has occasionally been performed in various parts of this country and Europe; but so far as my information extends it was first adopted, as a rule of practice, by the surgeons of the Hôtel-Dieu at Quebec, the first case having occurred, many years ago, in the hands of Dr. Morris, of that city. Within the last ten years the operation has also been performed several times by Dr. Carnochan, of New York. But the most remarkable

instance of the kind of which I have any knowledge, occurred in 1847 at Schuylkill Haven, Pennsylvania, in the hands of Dr. John G. Koehler, who removed simultaneously, on account of a railroad injury, both legs and one arm from a lad, aged thirteen years, recovery taking place without the supervention of any serious symptoms. The limbs were frightfully crushed, and the operation was performed within a short time after the accident. The arm being removed first, the pulse immediately sank, but under the influence of stimulants it rose sufficiently in five minutes to justify amputation of both legs below the knee. So excessive had been the shock of the system that the boy hardly experienced any pain during the operation.

The synchronous double operation may be performed by two surgeons, or by one alone, the latter being perhaps the preferable method. In either event, it is a matter of paramount importance to protect the patient from the loss of blood, the slightest effusion of which might prove prejudicial to his safety. Dr. Carnochan is in the habit of cutting off both limbs before he ties any vessels, and this is undoubtedly the preferable plan if we can be certain of having perfect control over the hemorrhage, as we may be if we have proper assistants, and the removal is effected rapidly by the flap operation.

SECT. V.—AFFECTIONS OF THE STUMP.

These affections are either of a primary or consecutive character, and both may be purely of a local, or of a local and constitutional origin. The primary consist of hemorrhage, spasm of the muscles, excessive pain, undue inflammation, osteomyelitis, and inordinate retraction of the soft parts, thereby permitting exposure of the bone. Among the secondary effects may be mentioned necrosis and exfoliation of the bone, degeneration of the nerves and neuralgic pain, aneurismal enlargement of the vessels, and contraction of the tendons in the neighborhood of the stump, by which the latter is drawn out of its proper position, and so made a source of inconvenience and discomfort.

1. PRIMARY AFFECTIONS.

a. Hemorrhage may come on soon after the dressing of the stump, or not until some time has elapsed; perhaps not for several days It is usually occasioned by the want of a sufficient number of ligatures, in consequence of the retraction of some of the smaller arteries, thereby escaping the surgeon's attention while he is looking out for the principal and more accessible branches; or it may be that the vessel has been cut obliquely, and that it has not been tied high enough up; or, finally, that the arterial tunics are so much diseased as to give way under the pressure of the cord before the formation of an adequate internal clot, as when the bleeding supervenes several days after the operation. However induced, or whatever may be the circumstances which give rise to the hemorrhage, the proper remedy consists in exposing the open artery, and securing it with the ligature, either by

separating the flaps, or, if adhesion is already far advanced, by dilating the canal along which the blood flows over a grooved director. The main artery of the limb is not tied unless it be found impossible, on account of disease, or some other cause, to make the application of the ligature at the stump.

Sometimes the hemorrhage is purely venous, the blood flowing away lazily, in a dark purple stream, without any jet; and when this is the case it will generally be found to depend upon the want of accurate coaptation of the flaps, or some defective application in the bandage, making either too little or too much pressure; in the former case enabling the vessels to remain open and gaping, and in the latter interfering with the passage of their contents. Occasionally the blood oozes out at different points, as water oozes out of a sponge, and this may take place either from the soft parts, or from the Haversian canals of the bones, or from the medullary membrane and the marrow. Arrest of the bleeding is usually effected simply by compression of the stump, the compress and roller being made to bear steadily against the offending vessels, aided by elevation and cold applications; when this fails, the ligature may be required, or, what is preferable, because altogether free from the danger of phlebitis, constriction of the vein by inclusion in the surrounding tissues. For this purpose, after being carefully dissected from its attachments, it is transfixed by a curved needle, armed with a small double cord, and drawn through an opening made for it in one of the adjoining muscles. Both ends of the cord are then brought out at the nearest angle of the wound, and retained for twenty-four hours, or removed at once, if there be no probability that the vessel will loose its hold. When the vein has been cut off unusually high up, so as not to admit of this procedure, I never hesitate to tie it, even if it be one of large size, such, for instance, as the femoral, although the operation should always, if possible, be avoided for the reason just stated. When the blood proceeds from the Haversian canals it will generally be necessary to undo the flaps, and apply a compress directly to the surface of the bone, the wound being kept open until the flow is arrested. Caustic applications must not be used for fear of causing necrosis.

b. Spasm of the muscles, which is frequently a source of great distress, and which presents itself in the form of jerks or twitchings, usually sets in within a few hours after the operation, and is generally most severe in persons of a nervous, irritable temperament. No patient, however, is ever entirely exempt from it after amputation, and it is always sure to be materially aggravated on the occurrence of inflammation. In regard to treatment much is to be done in the way of prophylaxis; by the judicious use of the roller to give equable support to the muscles of the stump, together with elevation of the part to favor venous return, and also by the early exhibition of a full anodyne. The use of morphia, or of morphia and antimony, along with warm fomentations, will be required if the spasm is at all severe when no such precautionary measures have been adopted.

c. The degree and continuance of the *pain* which follows an amputation will be influenced very materially by the character of the case,

the size of the limb, the presence or absence of complications, and, above all, by the temperament of the patient. Coming on usually as the system emerges from the influence of chloroform, it is sometimes remarkably slight, while at other times it is so severe as to require large quantities of anodyne medicines for its subjugation. When the pain is complicated with spasmodic twitching of the stump, as it generally is during the first twenty-four hours, it must be promptly met with morphia and antimony. In order to render these two occurrences as light as possible, I have long been in the habit of administering a full anodyne, generally a grain and a half of morphia, about two hours before the operation, and have never been disappointed in my expectations.

d. The *inflammation* consequent upon an operation of this kind may be either of the ordinary character, or it may be erysipelatous, the determining circumstances not being always appreciable. In general, however, the danger of erysipelatous action will be considerable when there has been severe shock, or excessive loss of blood, conjoined with previous bad health or habits of intemperance. It usually makes its appearance within the first forty-eight hours, and is characterized by the ordinary phenomena, such as a red dusky state of the skin, more or less throbbing, a sense of tension, and burning, smarting pain, with marked disorder of the general system. Whatever may be the degree or character of the inflammation, it is always hostile to the adhesive process; some parts may, it is true, unite in this way, but suppuration will be almost certain to follow, so as to lead to the necessity of healing the greater portion of the wound by granulation. In persons of a very delapidated constitution the inflammation may pass into gangrene. I have found this termination most commonly in patients of a scrofulous habit of body and in those whose system has been contaminated by syphilis.

The treatment of this disease must be conducted upon general antiphlogistic principles. Special attention must be paid to the state of the system, and with this view it will generally be necessary to employ a mildly stimulating course, consisting of quinine and milk punch, with blue mass and ipecacuanha to evacuate the bowels and correct the secretions. Morphia is given in liberal doses to allay pain and procure sleep. The best local remedies are the dilute tincture of iodine, with fomentations, or cataplasms, medicated with solutions of acetate of lead and opium. Leeches will generally prove prejudicial. Sometimes the disease is promptly arrested by the application of a large blister. If mortification is threatened, the parts are freely touched with nitrate of silver, sulphate of copper, or the dilute acid nitrate of mercury, and enveloped in a fermenting poultice. The chlorides are used for allaying fetor, and the syringe for washing away secretions from beneath the flaps.

e. Bad effects occasionally follow amputation in consequence of the development of *osteomyelitis;* an affection which has only recently begun to attract particular attention. In the Crimean war it was of such frequent occurrence that the question was seriously debated by a number of surgeons whether it would not be best to abandon ampu-

tation altogether in the continuity of the larger bones, and resort to disarticulation as a substitute. The disease is also sufficiently common in hospital and private practice, especially in cases of railway and other severe accidents, attended with violent concussion of the osseous tissues. The probability is that it is occasionally caused by injury inflicted in the act of sawing off the bone. However induced, it generally sets in within a short period after the operation, so that by the time the dressings are removed, as they usually are on the fourth or fifth day, it is found to have already made considerable progress, the marrow being of a brownish, blackish, or greenish appearance, of a soft, putrilaginous consistence, excessively fetid, and partially detached from the bone, which is itself either dead, or in a dying state, and more or less denuded of periosteum. The disease is generally attended with considerable pain, although in some of the cases that I have seen there was almost an entire absence of local suffering; it is not unfrequently coincident with pyemia and erysipelas. Hence the prognosis is often exceedingly unfavorable.

The treatment of osteomyelitis must be conducted upon general antiphlogistic principles, modified by the peculiarity of the constitutional symptoms. Great attention must be paid to cleanliness; the dressings must be frequently changed, and free use must be made of the chlorides. The judicious application of the nitrate of silver to the affected structures might possibly assist in circumscribing and ultimately arresting the morbid action. If the bone die, no attempt should be made to remove it until the part and system have sufficiently recovered from the effects of the disease to bear the shock of the operation.

f. Finally, amputation is occasionally followed by inordinate *retraction* of the muscles, so as to uncover the bone, and perhaps lead to the necessity of its removal. The accident is most liable to happen after amputation of the thigh, in consequence of the action of the numerous, large, and strong muscles in that situation, and cannot always be prevented even when more than ordinary care is taken in forming the stump. The occurrence is always to be deprecated, inasmuch as it not only interferes with the union of the flaps but is very apt to cause the death of the bone. The remedy consists in bandaging the limb firmly from above downwards, preceded by the application of long adhesive strips, and in placing the parts in the best condition for relaxing the affected muscles. When these means are unavailing, we may, provided the bone remains sound, divide some of the muscles subcutaneously, and then draw them forward, either with or without incision of the integuments, as the case may seem to demand. If the bone, however, be diseased, the best plan will be to saw it off higher up; but such an operation is often more hazardous than the original one, and should, therefore, always, if possible, be avoided.

2. SECONDARY AFFECTIONS.

The most common, as well as the most serious, secondary effects of amputation are, as was previously stated, necrosis of the bone,

neuralgia, development of synovial bursæ, varicose enlargement of the arteries, and permanent shortening of the tendons in the vicinity of the stump.

a. Disease of the *bone*, eventuating in a loss of its vitality, is induced in various ways; in general, it is caused by injury inflicted upon it during the operation, consisting either in the laceration and separation of the periosteum, or in the violent and destructive jarring of its substance. Uncovering of the bone, in consequence of too great a brevity of flap, and the accumulation around its extremity of pus, are also very apt to produce it. In rare cases it would seem to perish from excess of inflammatory action. The loss of vitality is indicated by the peculiar whitish or pale yellowish aspect of the bone, the absence of bloody points upon its surface, and the fact that it emits a characteristic hollow noise when it is struck with the handle of the knife. The marrow and its enveloping membrane generally retain their vitality for a short time after the osseous tissue has died, and this is the more likely to happen if the bone perishes only in a part of its circumference. I believe it will be found that necrosis, as a result of amputation, is more liable to occur in the thigh-bone than in any other piece of the skeleton, depending probably upon some peculiarity of organization. The tibia is also occasionally affected, and a similar occurrence is sometimes met with in the humerus. The dead bone may come off in the form, first, of an exfoliation, consisting merely of a part of its outer compact substance; or, secondly, as an osseous ring, with long, narrow, sharp spicula; or, finally, as a complete cylinder, as when it involves the entire circumference of the bone over an extent of several inches in length. The more common appearances exhibited by the necrosed bone are well displayed in the annexed drawing (fig. 135).

Fig. 135.



a

The sequester detached; at its lower part, *a*, including the whole thickness of the bone, but gradually shelving upwards, as such pieces usually do.

The management of these cases must be left very much to the operation of time, especially when the bone has perished high up, and when, in order to reach it, extensive dissection would be required. If, on the other hand, the necrosis is very limited, an attempt may be made to get rid of it with the saw, cutting-forceps, or trephine; but too much caution cannot be used even in such an operation, trifling though it may seem. I have seen death produced by it in two cases, and similar instances have been witnessed by others. It would seem, when a bone is thus affected, as if the system were more than usually intolerant of instrumental interference and loss of blood; the parts are generally excessively irritable, and the constitution rarely fails to sympathize with them in the most lively manner. Besides, the operation is necessarily attended with some degree of hemorrhage, and I am not certain that a patient

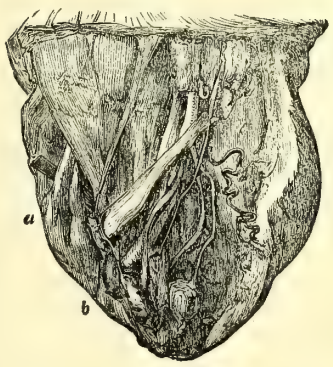
may not be destroyed in this way alone, especially if he be very feeble and irritable at the time.

Instances occur in which the dead bone, or sequester, is firmly and even obstinately imprisoned by the remains of the living, or, more properly speaking, by the new matter thrown out upon its surfaces; thus occasioning great difficulty in regard to its removal. Dr. Markoe, of the New York Hospital, had the kindness, a few years ago, to communicate to me the particulars of a case, wherein the sequester, consisting of an inner shell of the femur, was retained for many months by a spur of new osseous substance extending through an opening in its sides, in such a manner as to nail the dead and living parts together, but at the same time allowing the former to be moved freely backwards and forwards upon the latter. It was not until after several attempts had been made at extraction, attended with much pain and constitutional suffering, that riddance was finally effected by means of the chisel and forceps. For some very ingenious notions respecting the causes of necrosis in the bones of the stump after amputation, the reader is referred to a short paper by Dr. Markoe, in the Louisville Medical Review for July, 1856.

b. Another disagreeable, frequently, indeed, a most distressing effect of this operation is *neuralgia*, coming on at a variable period after its performance, and often continuing, despite the most judicious and persevering efforts at relief, to molest the patient during the remainder of his life. Supervening generally without any assignable cause, it is usually most common in nervous, irritable persons, who are subject to the disease in other parts of the body. Females are more prone to it than men, and in them the attack frequently coincides with the eruption of the menses. Sometimes the disease is periodical, especially in residents in malarious regions, the paroxysms coming and going very much as in intermittent fever. Most commonly, however, the pain is omnipresent, one portion of the day being as liable to bring it on as another. It is generally of a darting, shooting nature, or dull, heavy, and aching, and is invariably aggravated by damp states of the atmosphere, fatigue, and disorder of the digestive apparatus.

In the more violent forms of this affection the immediate cause of the difficulty is a bulbous enlargement of the nerves ramifying through the stump (fig. 136). This degeneration takes place, to a greater or less extent, after nearly every amputation, and is therefore to be considered as a disease only when it exists in excess. Under such circumstances the tumor, which sometimes attains the size of a hickory nut, or even of a pullet's egg, is of a firm, dense consistence, and is composed of a strong fibrous stroma, inlaid with hypertrophied and

Fig. 136.



Neuromata of stump, after amputation of the arm. A large mass at *a*; opposite *b*, the tumors are more defined.

curiously interlaced nervous trunks and filaments. It is, in fact, a true neuroma. The accompanying pain is exquisite, and the part is so sensitive as to be intolerant of the slightest touch; the general health is much affected, and the patient is remarkably susceptible of atmospheric vicissitudes, every change in the weather from warm to cold and dry to wet being followed by an increase of suffering. The malady is of a much more serious character than the other, and requires proportionably stronger measures. In general, nothing short of removal will avail; by excision, if the tumor be single and easily accessible; by amputation, if it be multiple and deep seated.

For the milder varieties of neuralgia the ordinary remedies will sometimes suffice, the same as in neuralgia in other parts of the body; especially quinine, or, if the patient be anemic, quinine and iron, combined, in either case, with strychnine and arsenious acid, belladonna, stramonium, or aconite; the effects of the articles being studiously watched, lest an over dose be given, and life placed in jeopardy. Sometimes good effects accrue from the exhibition of colchicum and morphia, administered in full doses at bedtime, as one drachm of the wine to a grain of the salt. The remedy is particularly valuable in subjects of a rheumatic state of the system. Locally iodine, blisters, issues, and other counter-irritants are used, along with anodyne embrocations. The stump is well protected from cold, friction, and pressure.

c. A *burse* sometimes forms upon the stump, generally immediately over the end of the bone, in consequence of the long-continued pressure of an ill-constructed and ill-adapted artificial leg. The tumor, in time, becomes exquisitely tender and painful, compelling the patient to seek relief. The seat and character of the disease are usually pointed out by the discoloration and swelling of the part, which often fluctuates on pressure. The history of the case, aided by the exploring needle, will readily serve to distinguish it from abscess, the only lesion with which it is likely to be confounded. The proper remedy is excision in the severer grades of the affection, and in the milder a more happy adaptation of the artificial to the natural limb.

d. Varicose enlargement of the *arteries* of the stump is extremely rare, only a few instances of it being upon record. Unless the disease is unusually extensive, which, however, it is not likely to be, nothing need be done for its relief, as it does not generally act even as an inconvenience.

e. Permanent shortening of the *tendons* in the immediate vicinity of the stump is sometimes a source of great discomfort, as well as of serious interference with the usefulness of the limb. The accident is most liable to happen in the tendons of the hamstring muscles after amputation of the leg, and in the tendo-Achillis after removal of the foot by Chopart's method. Much may be done, in both cases, in the way of prevention by attention to position during the after-treatment; it is, in fact, the neglect of this precaution that usually occasions the difficulty. When the accident is unavoidable, or is already fully established when first brought under the notice of the surgeon, rectification is attempted, generally with a fair prospect of success, by the subcutaneous section of the shortened tendons, and the subsequent use

of an extending apparatus, constructed on the principle of the double inclined plane, with such modifications as may be required to adapt it to each particular case.

SECT. VI.—CONSTITUTIONAL EFFECTS OF AMPUTATIONS.

The most common constitutional occurrences after amputations, especially of the larger limbs, are excessive prostration, traumatic fever, pyemia, congestion of the lungs, tetanus, retention of urine, and, as a secondary consequence, hectic irritation.

a. The *shock*, consequent upon amputation, is frequently extremely severe, and may be due, either partly or exclusively, to mere depression of the nervous system, caused by the extent, violence, and duration of the operation, to loss of blood, or to the effects of anæsthetic agents, or to all these circumstances combined. More or less nervous depression will almost necessarily occur during such an operation, however slight; but it generally passes off without any particular treatment, simply under the influence of repose, exposure to the air, and a drink of cold water. In the more severe forms of the affection, however, it may endanger life by its long-continuance or excess, and then demands prompt attention. The most appropriate remedies are lowering of the head, so as to facilitate the flow of blood to the brain; the administration of brandy and ammonia, by the mouth, if the patient can swallow, or by the rectum, if the power of deglutition be lost; a full dose of morphia; and sinapisms to the spine, extremities, and precordial region.

b. Traumatic fever generally sets in within from six to twelve hours after the operation, and will be violent or otherwise according to circumstances, of which the most important are, the extent of the previous shock and the loss of blood, and the temperament, habits, and state of health of the patient. It is characterized by heat and dryness of the skin, flushed countenance, suffusion of the eyes, headache, restlessness, excessive thirst, rapid respiration, and a frequent, hard, and irritable state of the pulse, attended, when there has been much hemorrhage, by a peculiar jarring impulse. These symptoms, in the milder cases, will often speedily subside spontaneously; but under opposite circumstances they will require attention, and, if the surgeon is not fully on his guard, he will be very apt to do a great deal more than is either necessary or proper. The fact is, this is not unfrequently the critical point in such cases; if we do too much, the patient is irretrievably gone, the consequence being death either from exhaustion, pyemia, erysipelas, or a low state of fever, which nothing can cure. Hence the greatest caution is to be observed; the symptoms must be watched, and the utmost care must be taken that they do not deceive us by their violence, which is often rather apparent than real, and therefore extremely apt to entrap the unwary and inexperienced. In general, it will suffice to administer a mild aperient, as a little Epsom salts, or a Seidlitz powder, to sponge the surface frequently with tepid water, and to give cooling, acidulated drinks, which are always very

grateful in these cases. If the fever threatens to be obstinate, a little antimony is prescribed, either alone or in union with morphia, to promote perspiration, allay the heart's action, and induce sleep. The lancet is scrupulously withheld, unless the symptoms are of extraordinary urgency, and the patient is very plethoric, without having been weakened by shock and loss of blood. Then a vein in the arm may be opened, and the effect of the stream carefully watched, the bleeding being arrested as soon as the pulse evinces signs of flagging.

Very often after amputations of the larger limbs, especially those performed for compound fractures and dislocations, gunshot wounds, and railway accidents, a low form of fever ensues, the system reacting badly, the countenance looking pale and haggard, the skin being icterode, cold, and doughy, and the pulse shattered, with great depression of spirits, and an utter indifference on the part of the patient as to his fate. It is difficult to say what is the real condition of the system under such circumstances; but if we may be allowed to indulge in conjecture, we may suppose that the disorder is mainly due to the loss of blood and nervous fluid consequent upon the excessive shock to the system at the time of the accident, heightened, perhaps, by the effect of the operation. However this may be, the system being depressed and withered, the issue is usually most disastrous, very few persons recovering, no matter what course may be adopted for their relief. Our chief reliance must obviously be upon stimulants, as brandy, quinine, ammonia, and nutritious broths and jellies, with opium to allay pain and procure sleep.

c. Amputations, especially those of the thigh, are often followed by *retention* of urine, caused apparently by partial paralysis of the bladder, or, rather, as it seems to me, by a want of proper volition, the bladder retaining its power, but the patient being unable to call it into action. It usually supervenes within the first twenty-four hours after the operation, and seldom lasts less than two or three days, when it gradually passes off. From what I have seen of this affection, in this class of cases, I am not disposed to ascribe to it, as some have done, an inflammatory origin; that such a condition occasionally exists is certain, but, in general, I am sure it does not. Knowing how frequent retention of urine is after this and other capital operations, the attendant should be diligently on the watch for it, and promptly use the catheter, if it should arise.

d. A not unfrequent event after this operation is *pyemia.* Experience shows that it is most to be dreaded in cases preceded by excessive shock of the system; hence it is very common after gunshot, railroad, and steamboat accidents, attended with extensive laceration of the soft parts, and after compound fractures and dislocations. The attack generally comes on within the first six or seven days, being ushered in by violent rigors alternating with flushes of heat, and followed by a bad state of the stump with aching pains in the limbs and joints, excessive thirst, restlessness, and a tendency to delirium even early in the disease. When the joints are involved there is commonly an erysipelatous blush upon the overlying skin, with great tenderness on pressure and exquisite pain on motion. The case generally proves fatal in less

than a week from its commencement, and examination after death usually reveals the existence of small and ill-defined abscesses in some of the internal organs, particularly in the lungs, liver, and spleen.

The treatment is by stimulants and tonics, as brandy and milk, quinine, and opium, given in large quantity to support the rapidly sinking powers of nature. Mercury, in the form of calomel, is sometimes useful, administered in doses of three grains every four or six hours, with a view, if possible, of touching the gums. The bowels are moved by enemas, all active purgation being inadmissible. Locally the ordinary remedies are employed; generally only such as are of a soothing character.

e. Congestion of the *lungs*, if not actual inflammation of these organs, is another effect of this operation, occurring either alone, or in conjunction with pyemia, erysipelas, or an adynamic state of the system. It generally comes on in a slow, insidious manner, and is therefore apt to make serious, if not fatal, inroads before its true nature is even suspected, none of the characteristic signs of pneumonic disease being present. The only way in which it is usually detected is by auscultation and percussion, or by the changes perceptible in the respiratory movements and the sounds of the chest. These changes are generally most conspicuous in the lower and posterior portions of the lungs, where the greatest amount of blood, in debilitated states of the system, is, in obedience to the laws of gravity, most liable to accumulate, and, consequently, to produce the greatest degree of mischief. In most of the cases of pulmonary congestion that I have met with after amputation of the larger limbs there was either an entire absence of pain and cough, or these symptoms were so trivial as, of themselves, to attract hardly any attention. The patient is able to lie upon his back or on either side, and it is not often that the respiration is materially hurried or embarrassed. Cupping and blistering are the most reliable local remedies, and the system must be supported with stimulants and tonics, aided by morphia and minute doses of tartrate of antimony and potassa. The prognosis is generally unfavorable, especially if the disease has made considerable progress and the patient is much exhausted.

f. The occurrence of *tetanus* after amputation is uncommon, especially in the more temperate regions of this and other countries. Mr. Curling, in his work on this disease, gives a table of 128 cases of traumatic tetanus, only three of which were caused by amputation. The affection is much more frequent in military than in civil practice, and is most liable to be produced in persons of a nervous, irritable temperament, in consequence of exposure to direct currents of cold air. A few years ago I lost a man on the third day after an amputation of the thigh solely from this cause; he had been moved, during my absence from the hospital, to an open door, so as to allow the wind to blow upon him in a full stream. I am familiar with the history of other cases that have been induced in a similar manner; and I refer to the fact in order to attract special attention to it. The treatment of this disease being discussed elsewhere, it is unnecessary to refer to it here.

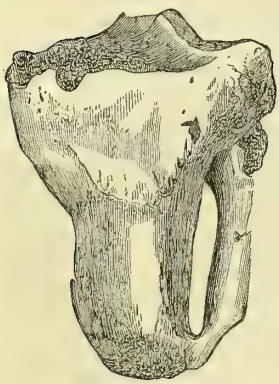
g. Hectic irritation is observed only, or chiefly, as a secondary effect

of amputation, being caused either by profuse suppuration, or a poisoned state of the blood and solids, from shock, hemorrhage, or the absorption of pus. The symptoms are characteristic; and the treatment consists of such means as are calculated to sustain the flagging powers of the system, especially quinine and iron, with aromatic sulphuric acid, milk punch, and nutritious food.

SECT. VII.—ARTIFICIAL LIMBS.

The stump, after the cicatrization of the wound, gradually undergoes, as might be expected, important changes in its several structures, so as to adapt it the better for the various hardships which it is destined to experience in the daily routine of a business life, and especially for the support of an artificial limb. The muscles, deprived of the power of motion, soon become pale and wasted, and are eventually transformed into hard, dense, cellulo-fibrous bands, entirely destitute of their primitive properties. The bloodvessels are obliterated as high up as their first large collateral branches, and converted into solid, rigid cords; the extremities of the nerves are expanded into large bulbous masses, of an elongated, cylindrical shape, exhibiting more of a fibrous than of a nervous structure; and the ends of the bones are rounded off, and covered in by a thin shell of osseous matter, which thus effectually closes the medullary canal, as seen in fig. 137. The cellulo-adipose substance gradually disappears, and the skin, unless habitually subjected to pressure, is rendered abnormally thin and sensitive. These changes are, of course, the work of time, and hence they are always more conspicuous in proportion to the age of the stump.

Fig. 137.

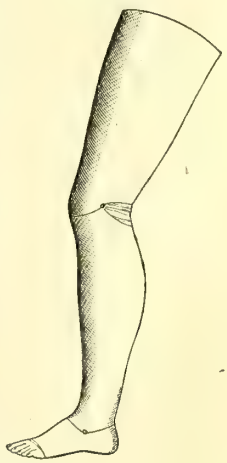


Appearances of bony stump after amputation.

The period at which the stump may be in a condition for the reception and support of an artificial limb must necessarily vary according to circumstances; if the operation has been well done, and the cicatrization has gone on favorably, the substitute may be used as early as the sixth or eighth week; though in general it will be better to wait some time longer, inasmuch as too early a recourse to it will be likely to render the parts sore and sensitive, if not the seat of ulceration and severe pain. So much, indeed, is the patient's comfort influenced by attention to this point that it is hardly possible to be too cautious respecting it. The stump should be tightly bandaged for several weeks previous to the application of the artificial limb, to promote absorption of redundant material, and thus impart to it a somewhat conical shape. Washing it well several times a day with a strong solution of tannin and alum will have the effect of hardening the integuments, so as to moderate their sensibility and prevent excoriation.

Great improvement has of late years been effected in the construction and adaptation of artificial limbs, and there is reason to believe that the inconvenience and suffering occasioned by their use are more frequently attributable to the misconduct of the surgeon than to the want of skill on the part of the manufacturer of the substitute. It has been only within a comparatively recent period that operators have hit upon the correct principles of making good and serviceable stumps; Allanson, nearly three-quarters of a century ago, understood the subject much better than it has been understood since, if we except the last ten or fifteen years. He strongly insisted upon a long and well-shaped stump, and exerted himself with great ability, but in vain, to induce the profession generally to follow his example. The happy changes which have lately been introduced into this department of operative surgery are, I believe, mainly due to the manufacturers of artificial limbs, who, with an ingenuity and a perseverance worthy of so good a cause, have reduced the whole process to one of principles founded upon the study of anatomy and mechanical philosophy. It would be difficult to conceive of any apparatus more beautiful in its construction, or more admirably adapted to the end proposed, than the artificial substitutes of Mr. Palmer, of this city, who obtained the prize medal at the great exhibition in London in 1851. Combining lightness with strength, and neatness with symmetry, they are worn with great comfort and satisfaction, and are apparently as perfect as any piece of human mechanism of the kind can well be made. The joints, constructed on the principle of the ball and socket articulation, are situated at the proper points, and their surfaces being well secured, move upon each other with great accuracy and facility, through the intervention of cords, wires, springs, and levers, the whole arrangement being a close imitation of the natural muscles and tendons, if not in shape, at least in position and function. The socket is made with special care, neatly fitting the stump, in every portion of its extent, and is well padded to prevent friction and excoriation, the pressure being diffused over the entire circumference of the stump, while the extremity of the latter is perfectly free in the interior of the former. The annexed cut (fig. 138), affords an illustration of this apparatus.

Fig. 138.



To enable the patient to wear his artificial limb with comfort and convenience, it is necessary that he should have a good long stump, well covered, perfectly even, and of proper shape, being neither too square and fleshy, on the one hand, nor too thin and conical, on the other. A short, thick, ill-formed stump is a great evil, from which the patient can promise himself no good; but which can hardly fail to be a constant source of annoyance and pain, becoming sore and excoriated under the slightest exercise. The duty of the surgeon is, therefore, one of great responsibility, and cannot be discharged without properly weighing, in

every instance, the probable consequences of the operation. When he has his choice, his invariable aim should be to make a long stump, so as to afford an abundant leverage and support for the artificial contrivance. In the leg and thigh its length should not, if possible, be less than nine or ten inches; hence the place of election, for the former, should be only about from three inches to three inches and a half above the ankle, and for the latter about the same distance above the knee. It is not always by any means, however, in the power of the surgeon to select the point where he might otherwise cut off the limb, and under such circumstances he must be contented in leaving as much substance as he can. If the leg is amputated very high up, the weight of the body may be supported upon the knee, especially if the patient's social position is such as to prevent him from wearing an expensive substitute, and this will be the more necessary because it is often very difficult, if not impossible, to preserve the straightness and flexibility of the joint in the event of a very short stump, such being its incessant tendency to retraction and anchylosis. It is for this reason that some surgeons have advised amputation of the thigh just above the knee, when accident or disease interferes with the formation of a suitable stump below; but, if we consider the difference in the danger of the two operations, we should hesitate before we give our sanction to such counsel, not forgetting that the risk increases with every inch the nearer we approach the trunk. In amputation of the thigh, the principal pressure of the artificial limb upon the stump is concentrated near the body, but care is taken not to apply any direct pressure to the perineum, lest it should produce excoriation.

I subjoin Mr. Palmer's instructions for the formation of suitable stumps in amputations of the leg and thigh, as they are now generally acted upon by the more accomplished operators of the country. For the leg, the first place of election is the lower third or fourth of the limb, with flaps, and a thorough removal, of course, of the malleolar projections. Secondly, the lowest point possible between the first place of election and the upper third at which a good flap can be formed. Thirdly, immediately below the tuberosity of the tibia, if not practicable to save four inches below the patella with the full use of the joint.

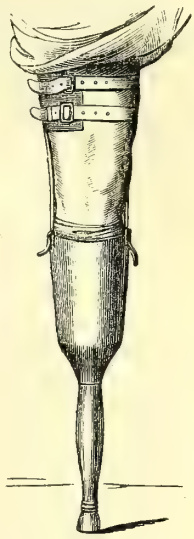
In amputations of the thigh, the first point of election is the lower third of the limb, so as to give at least ten inches from the perineum; if performed near to or at the knee, there must be complete removal of the condyles of the femur. Secondly, if necessary to go above this point, the object should be to save as much of the thigh as possible. In either case, the flap operation makes the best stump for the comfortable use of an artificial substitute.

In amputations in children, the development of the limb is always partially arrested, so that, by the time the individual attains his full stature, it will be several inches shorter, as well as thinner, than its fellow of the opposite side. Now, surgeons in applying this knowledge to amputations of the inferior extremity, have advised that it should never be cut off below the knee, but at the lower third of the thigh,

on the ground that, if this precaution be neglected, one knee will ultimately be elevated a considerable distance above the other, thereby imparting to the gait a peculiar grotesque appearance. Experience, however, has shown that amputation of the leg, even if the stump is only a few inches in length, instead of being an objection, is a decided advantage, the limb thus affording a much longer leverage than when it is cut off through the thigh, for the adaptation of the artificial substitute, the knee-joint of which can always be made to correspond, in situation, with that of the sound limb. Moreover, by adopting this procedure, the weight of the body, provided the stump is not too long, is supported upon the knee; another most important desideratum under such circumstances.

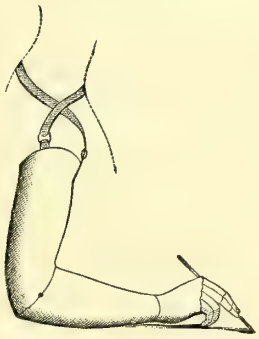
An ingenious artificial limb was recently devised by Dr. Bly, of Rochester. Besides combining lightness with elegance, durability, and strength of construction, it claims the advantage of admitting of lateral motion at the ankle joint, with a view of facilitating progression. The contrivance appears well in the model, but I have not seen it tested in practice.

Fig. 139.



The annexed drawing (fig. 139) conveys a good idea of the artificial limb usually worn by the laboring classes after the loss of a leg or thigh. It may be made very light, and, when the stump is of proper length, affords an admirable substitute, the person being able to walk nearly with the same facility as in the natural state.

Fig. 140.



Various attempts have been made to construct artificial hands and arms. Mr. Palmer, after many trials, has at length devised a limb (fig. 140), which, in point of neatness and adaptedness, leaves hardly anything to be desired upon the subject.

SECT. VIII.—MORTALITY AFTER AMPUTATIONS.

The mortality from amputations is so much influenced by extraneous and intrinsic circumstances, and requires such a vast amount of statistical material for comparison and contrast, that it is extremely difficult, if not impossible, in the existing state of the science, to arrive at any satisfactory conclusions respecting it. It has long been known that the danger of the operation is greater in proportion to its proximity to the trunk and the size of the limb. Hence, amputation of the leg is less hazardous than amputation of the thigh, and of the thigh in

its continuity than of the thigh at the hip-joint. The mortality of the operation is also greater, as a general rule, in hospital than in private practice, in military than in civil practice, and in private practice in cities than in the country. Amputations on account of railway accidents are extremely dangerous, and are liable to be followed by the worst consequences, even in subjects perfectly healthy at the time of the accident, owing to the excessive tendency to mortification and pyemia.

The circumstances which mainly influence the mortality after amputation may be conveniently arranged into four classes, one of which refers to the age, previous health, and social position of the patient; the second to the causes necessitating the operation; the third to the nature, seat, and extent of the operation; and the last to the after-treatment.

1. It will readily be granted that the condition of the *patient* at the time of the accident rendering amputation necessary must exert an important influence upon his fate. If he be old, broken in constitution, or in a state of poverty, so as to preclude the possibility of receiving proper attention after the operation has been performed, the chances are that he will die, either from shock, erysipelas, pyemia, or congestion of the lungs. The previous state of his health exerts no little influence upon the recovery; not, perhaps, however, to the extent that is generally imagined. A person who is in bad health at the time he is severely injured cannot be expected to bear the shock of an amputation with the same impunity as one whose health is good. The system, exhausted by previous suffering, is ill qualified in such a case to react favorably after the nervous depression consequent upon a severe operation.

Age also exerts considerable influence over recovery. Children, as a general rule, bear amputation better than adults and elderly persons, being less subject to attacks of erysipelas and pyemia, and making a more rapid recovery. The parts, too, unite more frequently by the first intention. At the Hôpital des Enfants in Paris, Guersant, who annually performs from fifteen to twenty operations of this kind, including all the larger limbs, and also occasionally the hip and shoulder joints, does not lose more than one out of about nine cases. He ascribes his extraordinary success mainly to two circumstances; first, a thorough preparation of the system, and secondly, the use of an abundance of good, wholesome, and nutritious food immediately after the operation, on the well-known principle that children do not tolerate abstinence nearly as well as adults. It should be added that nearly all the cases in this Institution demanding amputation are of a scrofulous nature.

The social position, or the habits and occupation of the patient, will influence the result of an amputation. The poor man cannot command the same care and attention as the rich; he often suffers for want of proper food and nursing, and even medicine, at a time, perhaps, when he is most in need of them, and there is no doubt that many patients perish from this cause alone that might otherwise be saved. Intemperance in eating and drinking, and unwholesome occu-

pations must necessarily produce a prejudicial influence upon the result.

2. The influence of the *causes* necessitating amputation has long been a subject of remark on the part of practitioners, both in private and public. Thus, it is an established fact that a person who undergoes amputation of one of the larger limbs on account of a severe injury, as a compound fracture, or a lacerated and contused wound, is much more likely to perish from its effects than one who loses a limb on account of chronic disease. The system, in the former case, deeply depressed by the shock of the accident, often reacts very slowly and imperfectly, and is therefore ill prepared for the approaching ordeal of another severe commotion, the effect of which is felt by every organ and tissue of the body. In disease, on the contrary, the constitution, although perhaps extensively implicated, has become, as it were, inured to suffering, and, unless too much prostrated, will generally be immensely benefited by the removal of the offending parts. The chief exception to this rule is in malignant affections, in which, in consequence of the vitiated state of the solids and fluids, amputation is often followed, and that very rapidly, by the worst results.

3. In considering the probable result of a case of amputation, we must not forget to take into view the nature, seat, and extent of the *operation*. Experience has proved that in practice, primary amputation is, other things being equal, a decidedly more dangerous procedure than secondary. The very fact that such an operation is required shows that the accident must have been a severe one, involving perhaps the most dreadful lesions of the bones, muscles, joints, and blood-vessels, with frightful depression of the nervous system. Now, it is surely impossible that a patient thus circumstanced should be in a favorable condition to submit to another severe shock, such as must necessarily attend the removal of the affected limb, within a short time after reaction has been established. The statistics, both of private and hospital practice, in America and Europe, are decisive upon this subject, proving beyond the possibility of doubt, the greater mortality after primary than secondary amputations. Thus of 48 primary amputations of the thigh, leg, and arm, performed in the London hospitals from June, 1855 to June, 1856, inclusive, 26 terminated fatally, or upwards of one-half, while in 156 secondary ones the number of deaths was only 35, or in the ratio of about 1 to 4½.

The size and situation of the wound exert an important influence upon the recovery. Here again the statistics furnished by various authorities are most eloquent and decisive. They have conclusively established the fact, now regarded as a great general law, that the larger the wound is and the nearer it is to the trunk the greater is the danger to life. Thus, Malgaigne, in his statistics of amputations of all kinds in the hospitals of Paris, found that the mortality after removal of the great toe was in the ratio of one to six, whereas that of one of the smaller toes was only as one to twenty-six. In amputations of the foot the proportion of deaths was about twenty-five per cent., of the leg fifty-six per cent., and of the thigh sixty-two per cent. These results have been abundantly verified by the statistics of other insti-

tutions, as well as by those of military and private experience, and they are full of interest, as establishing a law, which should never, if possible, be violated in practice.

The causes which induce this difference in the larger and smaller amputations are chiefly shock, hemorrhage, pulmonary congestion, pyemia, erysipelas, profuse suppuration, and gangrene of the stump. Tetanus, too, is more frequent after the former than the latter, although the mortality from this affection is not great under any circumstances, especially in the more temperate regions of this and other countries. It is certainly not difficult to understand the reason why the removal of a large limb should be attended with so much more risk than that of a small one. In the former case, the patient has to contend not only with the shock of the accident necessitating amputation, which is often of itself almost sufficient to destroy him, but as soon as reaction is established he is subjected to another source of depression, perhaps almost equally great, from the operation, frequently involving copious hemorrhage, and liable to be followed by profuse suppuration and high febrile excitement, all tending to depress and exhaust the vital powers. In the latter, on the contrary, there is little or no shock, either from the accident or the operation; the loss of blood is inconsiderable; and the inflammatory effects, local and constitutional, are comparatively trivial. In short, there is no disorganization of the blood as there is in the former, and hence no predisposition to pyemia, or purulent infection, and pulmonary congestion, which are a source of so much mortality after the large amputations performed for severe injuries.

4. Finally, it needs no labored argument to prove that the mortality from amputation must be materially affected by the nature of the *after-treatment.* That many persons perish after such an operation from sheer neglect, bad nursing, or bad surgical management, is a fact too well known to require comment. This is true both of private and of hospital practice, but the remark applies with increased force when it is made with reference to military practice, which, however well the surgical staff of an army may be organized, must often, from the very necessity of the circumstances in which the operations are performed, and the difficulty of conducting the after-treatment in a proper, and satisfactory manner, be followed by the most disastrous results, many lives being lost that might under more auspicious circumstances, as to locality, comfort, and convenience, be saved. The state of the atmosphere, as it respects purity and temperature, the prevalence of epidemic diseases, mental depression, want of proper diet, severe depletion, and inattention to the dressings all exert a more or less powerful influence upon the issue of such an operation. The crowded wards of hospitals in large cities, incessantly pervaded by foul air, are notoriously prejudicial to recovery after amputations; gangrene, exhausting suppuration, erysipelas, and pyemia are the common lot of such patients, and the consequence is that many of them perish. Hence it is that private practice, especially that of the country, always shows a much more favorable result than that of large public institutions, or that of large towns and cities. During epidemic

diseases, the per centage of deaths from amputations always exhibits a great increase; for it is then that patients are particularly prone to erysipelas, pyemia, and congestive pneumonia. Starvation and depletion are a serious source of mortality after this operation, establishing, as it does, a tendency to purulent infection and a typhoid state of the system, from which often no stimulants, however powerful and well-directed, can afterwards rouse it. I regard such treatment after amputation of a large limb, as, indeed, after every other capital operation, as a great evil, and one which, in my judgment, demands thorough reform on the part of our civil and military practitioners. Finally, I may mention, as another source of mortality, want of attention to the dressings, which, if allowed to remain on too long, not only taint the surrounding atmosphere, but favor the absorption of pus, much to the detriment both of the part and system.

I subjoin the following summary of the statistics of the amputations performed at the Pennsylvania, New York, and Massachusetts Hospitals, because it seems to place the whole subject of the mortality after these operations in a clear and satisfactory light. It is founded upon the reports of Dr. Norris, Dr. Lente, and Dr. Hayward, and embraces the results of five hundred and forty-six cases.

Dr. Norris's statistics of amputations at the Pennsylvania Hospital comprise a period of twenty years, extending from 1831 to 1850 inclusive. The whole number of operations upon large limbs is 174, of which 44 proved fatal, thus exhibiting a mortality of 25.2 per cent. The whole number of amputations of the thigh was 33, of which 8 were fatal, or nearly one in four; of the leg 69, with a mortality of 29, or 42 per cent.; of the knee 1, which was successful; of the arm 32, of which 5 perished, or one in six and a third; and of the shoulder-joint 6, of which 1 proved fatal.

Of 52 primary amputations of the lower extremity, 25 were fatal, while of 28 secondary operations only 8 were fatal, thus exhibiting a mortality of 28.6 per cent. as compared with 48 of the former. Of 22 amputations of the inferior extremity for disease 4 were fatal, yielding a mortality of 18.1 per cent.

The ages of the patients operated upon were as follows: Of 49 under 20 years, 4 died; of 56 between 20 and 30, 11 died; of 47 between 30 and 40, 18 died; of 37 between 40 and 50, 13 died; and of 5 over 50, 1 died.

The above summary will be found, on comparison, to differ essentially, in one particular, from that given by Dr. Norris himself, in his statistics. Thus, he makes 115 primary amputations of the thigh, leg, arm, and forearm, yield a mortality only of 27, or at the rate of 23.4 per cent., while 41 secondary amputations of the same limbs afford a mortality of 16, or at the rate of 39.3 per cent. Now such a result is, as is well known, wholly at variance with general experience; for it is universally admitted that secondary amputations are less fatal than primary; and it must always be so from the fact that primary amputations are commonly performed for more serious injuries than secondary; injuries which are often of themselves almost inevitably fatal under any treatment, such as the crushing of limbs by railway

cars, heavily-loaded wagons, ferry-crossings, high falls, and gunshot wounds, involving joints, large vessels, and other important structures. On the other hand, the very circumstance of waiting for secondary amputation indicates a comparatively slighter lesion, and generally a fair prospect not only of saving life but of limb also. But the explanation in the discrepancy in Dr. Norris's statistics is discovered in the fact that he classes as primary only those cases in which the operation was performed during the first twenty-four hours after the occurrence of the accident, whereas the general rule is to regard every instance as primary until a sufficient degree of reaction has taken place to justify the use of the knife, without taking lapse of time into account at all. Thus, if we wait for the system to come up, an amputation performed on the second day has as much claim to be classed as primary as though it had been performed on the first day, and, indeed, it seems almost impossible, if we reject Dr. Norris's rule, to specify any certain demarcation, as to time, between a primary and a secondary operation. We therefore consider those amputations as secondary which are performed after the occurrence of inflammation, or of inflammation and suppuration. Thus, many of the amputations at the New York Hospital, classed as primary, were performed on the second, third, or fourth day, and some even as late as the sixth or seventh. Frequently the delay was caused only by the circumstance that the patient had to be conveyed from a long distance in the country to the hospital; the shock of the injury and the fatigue of the journey preventing such a degree of reaction as to constitute inflammation. It would certainly be improper, and lead to much confusion, in attempts at classification and generalization, to rank such operations as secondary merely on account of lapse of time. In order, therefore, to make a useful comparison of Dr. Norris's very extensive and valuable tables with those of other statisticians, I have taken the liberty of drawing my own deductions. It may also be noticed that no distinction has been made between the relative mortality of primary and secondary amputations of the upper extremity in its continuity, because the mortality is so small as to render such a distinction practically useless.

Dr. Lente's account of the amputations at the New York Hospital embraces a period of eighteen years, commencing in 1839, and terminating in 1857. The whole number of cases was 305, of which 139, or 45.5 per cent., proved fatal. The thigh was amputated in 97 cases, of which 51 were fatal, showing a mortality of 52.5 per cent.; the leg in 102, with a mortality of about 34 per cent.; the arm in 58, with a mortality of 15 cases, or at the rate of nearly one in four; and the forearm in 39, with a loss of 8, or at the rate of 20.5 per cent. Of 4 cases of amputation at the hip-joint all were fatal; of 9 at the knee-joint 4 died; and of 19 cases at the shoulder-joint 11 proved fatal.

It will thus be seen that the number of cases of amputation of the lower extremity was 212, of which 86 terminated fatally, showing a mortality of 40.6 per cent.; and of the upper extremity 106, of which 31 died, the rate of mortality being 30 per cent.

Of the amputations of the thigh 33 were by the double flap method,

with a loss of 14, or at the rate of 42.4 per cent.; and 28 by the circular, with a loss of 15, or 53.6 per cent. Of the operations upon the legs 21 were by the flap method, and 58 by the circular, the mortality in the former being 38.1 per cent., and of the latter 22.4 per cent.

Of 70 primary amputations of the thigh and leg, 39 were fatal, exhibiting a mortality of 55 per cent.; and of 73 secondary 32 were fatal, or 24.1 per cent.

The ages of the patients operated upon, with their respective mortality, were as follows: For the lower extremity, under 10 years, 2 cases, both recovered; between 10 and 20, 18 cures and 14 deaths; between 20 and 30, 23 cures and 18 deaths; between 30 and 40, 15 cures and 12 deaths; between 40 and 50, 7 cures and 10 deaths; over 50, 2 cures and 2 deaths.

It would seem that the ratio of mortality after amputations at the New York Hospital, during the above period, was very different in different years. Thus, from 1848 to 1851, of seventeen operations upon the thigh, only four were successful. From 1851 to 1857, the number of amputations of the thigh was forty-six, of which eighteen were cured. During the three years above alluded to, there was a remarkable fatality attending all operations at the institution, owing to the prevalence of erysipelas, hospital gangrene, purulent infection, and kindred diseases. This circumstance led to a remodelling and rebuilding of the establishment, and the good effect is seen in the very great decrease in the mortality which has since occurred. Similar facts have been noticed, from time to time, in other hospitals, both in America and Europe.

The statistics of the Massachusetts General Hospital have been furnished by Dr. Hayward of Boston, and relate to amputations of the large limbs which occurred from the opening of the establishment to January 1, 1840, the whole number of cases being 67, of which 15 proved fatal, the mortality being thus 22.4 per cent. Of these cases 34 were amputations of the thigh, of which 9 proved fatal, or at the rate of 26.5 per cent.; 23 of the leg, with a mortality of 5, or 21.7 per cent.; 4 of the arm, which all recovered; and 6 of the forearm, of which one proved fatal.

Of 10 primary amputations of the lower extremity, 5 were fatal, and of 10 secondary 4 were fatal. Of 37 operations performed for disease 5 died, and it is worthy of note that 23 of these cases were amputations of the thigh.

The ages were as follows: Under twenty years, thirteen, of which one died; from twenty to thirty, thirty-one, of which eight died; from thirty to forty, nine, of which three died; from forty to fifty, ten, of which two died; from fifty to sixty, three, of which one died; and over seventy, one, which recovered.

Having thus given the results of amputations at each of the above hospitals, it will not be uninteresting to state their aggregate results. The whole number of cases, as already mentioned, is 546, of which 198 proved fatal, thus showing a mortality of 36.2 per cent. The thigh was amputated in 164 cases, of which 68 died, or 41.4 per cent.; the leg in 194 cases, of which 68, or 35 per cent. perished; the arm

in 94, of which 20 died, or 21.2 per cent.; and the forearm in 85, with a mortality of 11, or 12.9 per cent.

Of 133 primary amputations of the lower extremity in its continuity 69 died, or 51.9 per cent.; while of 111 secondary amputations only 44 were lost, or 39.6 per cent. Of 117 operations performed for disease 23 died, that is, 19.5 per cent. These cases include several double operations of the legs, and of these a majority recovered. Four amputations at the hip-joint are included in the tables, and all these proved fatal. Of 10 amputations at the knee 5 were lost. Five of the ten were primary, one secondary, and three for disease; of the first two died, of the second one, and of the third two. The shoulder-joint was the seat of operation in 25 cases, of which 12 were fatal, or 48 per cent.

In regard to the ages of the patients operated upon in the three hospitals, the mortality in all, under twenty years, was 20 per cent.; between 20 and 30, 29 per cent.; between 30 and 40, 40 per cent.; between 40 and 50, 40 per cent.; and over 50, 33.3 per cent.; the number of cases, however, being only twelve, and therefore too small to justify any general deduction as to the rate of mortality.

Respecting the relative mortality of the circular and flap operations, the statistics of the Pennsylvania and Massachusetts General Hospitals are silent, and I am therefore unable to compare it with that of the New York Hospital.

A comparison may next be instituted between the mortality of amputations in the practice of American and European surgeons. In doing this, I shall take as my guide the statistics of the above establishments, and those furnished by Mr. Benjamin Phillips, of London. Of 545 cases, analyzed by the English author, embracing primary and secondary amputations, and amputations for various diseases, of the thigh, leg, arm, and forearm, in France, Germany, and Great Britain, 127 proved fatal, thus exhibiting a mortality of about 23 per cent. Of 491 cases in the three American hospitals, 134 died, giving a mortality 27.30 per cent., a result somewhat higher than the foreign practice. It is worthy of remark, however, that a number of Mr. Phillips's cases were taken from the private practice of European hospital surgeons, and if we bear in mind the fact that the mortality after amputations is always, for obvious reasons, less, the world over, in private than in hospital practice, it will be found that the ratio of mortality is about the same in the two countries, that is, about 23 per cent.

CHAPTER XVIII.

EXCISION OF THE BONES AND JOINTS.

THE term excision serves to denote the removal of a bone whether in its continuity or at its extremity, whether it be limited to a portion of its extent or embrace its totality. When only the head of a bone is concerned in the operation, the word decapitation is occasionally used, and, as meaning the same thing, some authors have adopted the name of exsection. Excision differs from amputation in this, that, while in the latter the bone is removed along with the soft parts which surround it, in the former the bone alone is cut away, the integuments, muscles, and other tissues being retained, in order that they may contribute to the future usefulness of the limb; or, in other and more comprehensive language, while in the one case all the structures are destroyed, in the other as many of them as possible are preserved. Hence this department of surgery has very appropriately been denominated *conservative* surgery, and it is most gratifying to know that it constitutes one of the leading characteristics of the healing art of the present day. It is not to be expected that excision of the bones and joints will ever entirely supersede the necessity of amputation, for as long as the various tissues of the body are subject to disease and accident, so long will they require removal by the knife, in order to prevent the extension of their effects; but that the frequency of the operation will eventually be greatly diminished, the experience of the last fifteen years abundantly attests. Conservative surgery is still in its infancy, and it is needless to conceal the fact that it will take a long time to determine its legitimate limits. Up to the present moment we have no adequate statistical information respecting excision of any of the bones and joints to justify us in delivering a definite judgment upon its true value. The facts that have transpired in relation to the operation are too widely scattered to render them available for the purposes of a rigid and faithful analysis. Such a task would involve a profound consideration of the history of the operation, in all its varied bearings, and would demand an amount of time, labor, and talent, which few professional men are able to command.

Although incidental mention of excision of the bones occurs in the writings of some of the earlier surgeons, yet it is probable that, if such an operation was ever performed by them, it was in great measure, if not entirely, limited to the removal of the protruding ends of fractured bones. However this may be, it is certain that there is no well authenticated case of excision of the heads of any of the

bones until 1762, when Mr. Filkin, of Norwich, removed those of the knee-joint. Soon after this a similar service was performed for the superior extremity of the humerus by Vigaroux, David, and White. In 1781, Mr. Park, of Liverpool, repeated Filkin's operation, and, from the gratifying success attending it, he was led to propose its extension to all the principal articulations, much to the surprise of most of his contemporaries, who looked upon the measure as harsh and reckless. The consequence was that the proceeding met with much opposition, and it might even have been entirely lost sight of if it had not been for the boldness and skill of Moreau, the elder, of Bar-sur-Ornain, who, towards the close of the last century, exsected, in rapid succession, the articular extremities of the shoulder, knee and elbow. The success of the French surgeon was followed up by that of his son and successor, who obtained great celebrity for his operations upon the joints, attracting patients from all parts of France, and who, at various intervals, embodied the results of his observation and experience in separate monographs addressed to the Academy of surgery at Paris and other learned societies. In the early part of the present century excision of the joints received a powerful and salutary impulse from the French army surgeons, particularly Larrey, Percy, Willaume and Bottin, who repeatedly performed extirpation of the heads of the bones, especially those of the shoulder, on account of gunshot injury. The operation, indeed, was performed, at one time, upon a large scale, and many limbs, as well as lives, were doubtless saved by it. Notwithstanding this, however, the procedure was generally regarded with suspicion in Great Britain, where, although it originated there, it made no real progress until thirty years ago, when, chiefly through the example of Mr. Liston and Mr. Syme, it began to attract the universal attention of medical men. During the last few years the operation has been performed in numerous instances, by surgeons of the highest eminence, upon nearly all the principal articulations, and the results have been such as to warrant the belief that this department of the healing art is destined rapidly to undergo a most salutary change. In this country excision of the joints has hitherto been greatly neglected, both in hospital and private practice; that this, however, will be the case any longer is not at all probable when we reflect upon the intelligence, zeal, and skill of our surgeons. All innovations require time for their adoption, and what De Condillac said of another subject is equally true of this. "Il est rare que l'on arrive tout-à-coup à l'évidence: dans toutes les sciences et dans tous les arts, on a commencé par une espèce de talonnement."

Excision of the bones in their continuity has been practised, for various purposes, for a long time, and modern surgery is indebted to it for many of its most brilliant exploits. It is in this department, more particularly, that American operators have displayed their greatest skill. Commencing with excision of the inferior jaw by Dr. Deadrick, of Tennessee, in 1810, we may with just pride point to the operations of Mott upon the clavicle, of Mussey, McClellan, and Gilbert upon the scapula, of Butt and Carnochan upon the ulna, not to mention numerous minor cases, which, although less known, have re-

flected the highest credit upon the scientific character of the profession, and conferred the greatest benefit upon a class of sufferers who would otherwise have been doomed to loss of limb and life.

Instruments.—Various instruments are required for the ready and successful performance of this operation, and it is always desirable to have rather too many than too few, so that every emergency may be promptly met as it arises. The incisions through the skin and muscles are made with ordinary scalpels, but for detaching the bones from the soft parts and dividing the ligaments, stout, probe-pointed knives, with broad, steel handles, convex and semi-sharp at the end, will be necessary. Excision of the bone is effected with a hand-saw, a pair of pliers, or the gouge and chisel, according to the structure, size, and situation of the affected piece. The saw, which may be a common amputating one, should be from six to ten inches in length by from three to twelve lines in width, its teeth being sharp and widely set, and its handle long and thick. In addition to this instrument, which will be found to be of great service in almost every case of excision,

Fig. 141.



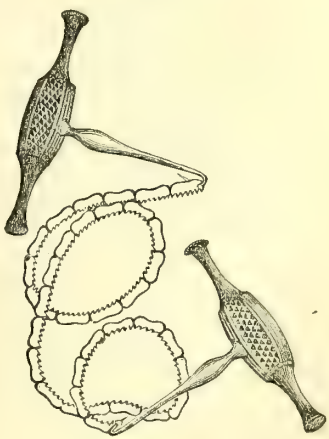
it will be well to have upon the tray a Hey's saw (fig. 141), and also a very narrow concave saw (fig. 142), with a blunt end, in the event of

Fig. 142.



its being necessary to divide the bone from behind forwards. As to the chain saw (fig. 143), even in its most approved forms, it may well be dispensed with, as its use is generally only productive of delay, vexation and disappointment. Bone-forceps or pliers (figs. 144–5–6), usually known as Liston's, although long ago described and delineated by Scultetus, should be at hand; of various shapes and sizes, as they may frequently be used with great advantage in places where it is impossible to introduce and work the saw. The surgeon should also be provided with several gouges and chisels, a strong mallet, trephines, scrapers, and a large elevator, together with a thick leather strap or leaden spatula for protecting the soft parts during the divi-

Fig. 143.



sion of the bone, suitable instruments for holding the flaps apart, and a syringe for washing out the wound or clearing away saw-dust and the debris of diseased bone and cartilage.

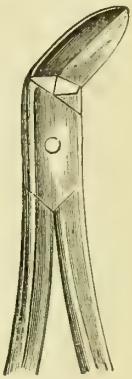
Fig. 144.



Fig. 145.



Fig. 146.



From this catalogue of instruments I have purposely excluded the tourniquet, which is not only unnecessary, but absolutely hurtful in excision of the bones and joints. If proper care be used, the surgeon will seldom lay open any of the more important arteries, none certainly which may not be readily secured by the ligature; there is, therefore, no need of such an instrument, which would only serve to dam up the blood in the larger veins, and thus cause injurious waste.

Position of the Patient.—The position of the patient, the surgeon, and the assistants, as well as the number of the latter, varies in different cases and under different circumstances, and does not admit of any precise rule. Generally speaking, the recumbent posture will be the most suitable, especially if chloroform is given and the operation is at all likely to prove tedious. In cases of any magnitude, as in exsection of the knee-joint, the number of assistants should not be less than five or six; one administering the anæsthetic, two holding the limb, one handing instruments and tying arteries, and another having charge of the sponges.

As it respects the operation itself, it may be conveniently considered as consisting of three stages, the division of the soft parts, the excision of the bone, and the dressing of the wound.

Incisions.—In planning the incisions, care must of course be taken not to interfere with any structures, the division of which might compromise in any way the result of the operation. The sheaths of the tendons are to be especially avoided. To lay them open would be to invite inflammation and plastic deposit, which could not fail to impair their usefulness. The nervous trunks are turned aside, out of harm's way, and the larger vessels, both arterial and venous, are studiously protected from injury.

The number and direction of the incisions will necessarily vary in different cases. Sometimes a single longitudinal cut will be sufficient, even in such a joint as that of the shoulder; in general, however, they should be so arranged as to enable us to form a good-sized flap, either of a semi-lunar, horseshoe, or square shape, as this will afford more ready access to the affected bone, as well as greater facility for sawing it. Incisions made after the manner of some of those depicted in the chapter on minor surgery will afford the surgeon an opportunity of adapting his operations to any case that will be likely to come under his observation.

The elliptical incision may be adopted, if it be necessary to remove any integument on account of disease. Whatever plan be pursued, the great rule is to sacrifice as little soft substance as possible. Even when the flap is very large and unseemly, it must not be retrenched, experience having proved that it will always contract down to the proper dimensions during the progress of the cure. In separating the bone from its muscular and ligamentous connections, the knife must be kept as close as possible to its surface; any deviation from this rule will be likely to be followed by the division of structures which should not be meddled with, especially important bloodvessels.

Removal of the Bone.—Insulation of the bone having been effected, it is next to be pushed through the wound, and sawn off, the parts around being carefully protected from injury by a piece of leather, or a metallic spatula placed underneath. Whenever it is feasible, I prefer sawing off the bone to cutting it away with the pliers, as the surface thus made is more smooth, as well as less bruised, and, consequently, more liable to heal well. In operating upon the smaller bones, as those of the carpus and tarsus, we are generally obliged to make free use of the gouge and chisel. In whatever manner the excision be accomplished, the invariable rule is to cut through the healthy structure; and this is applicable even when the bone is merely denuded of its periosteum, observation having shown that, when the osseous tissue is divested of its natural covering, it is either already dead, or will soon die. In excision of the long bones, the condition of the medullary canal and its contents should always be carefully scrutinized, with a view of ascertaining whether the part should be still further retrenched or not. Imperfect excision is worse than useless, as no thorough cure can take place after it without another operation. Finally, when two bones require to be removed, as, for example, in excision of the tibia and fibula, they should be sawn off upon the same level, otherwise the limb will be apt to be forced to one side, and so be rendered comparatively worthless.

Dressing.—Bleeding having been arrested, the wound is washed out with cool water, thrown in with a large syringe, in order to get rid of the sawdust, which, if allowed to remain, never fails to act as a foreign substance, liable to provoke suppuration and erysipelas, if not worse consequences. Any sinuses that may exist are also pared or laid open. The edges of the wound are then approximated by the interrupted suture and adhesive plaster, aided, if necessary, by a compress and bandage. The most dependent portion of the wound, however,

should always be kept patent by means of a small tent or tube, to admit of the necessary drainage. If this precaution be neglected, the result will be that the secretions, which are always more or less profuse after such an operation, will accumulate in the wound, thus not only impeding the cure, but often inducing necrosis of the bones, and affording an opportunity for the easy entrance of pus into the system.

Before the patient is returned to bed, the limb should be placed in the position in which it is to rest during the after-treatment, and kept perfectly quiet by means of appropriate apparatus. In excision of the inferior extremity osseous union is usually desired, as the limb would hardly be useful without it, and hence it will not be proper, as a general rule, to make passive motion. In the upper extremity, however, this rule is not applicable; here motion is both sought for and attained at all hazard, an anchylosed wrist, elbow, or shoulder being of little value.

The great sources of danger after excision of the bones and joints, are excessive suppuration, pyemia, and erysipelas. These accidents are to be carefully guarded against by the ordinary means, and treated upon general principles in the event of their occurrence. If the convalescence be unusually protracted, and especially if the wound be slow in healing, if sinuses form, or if there be much discharge of an unhealthy character, there will be reason to suspect that the bones have again become diseased, and that further interference will be required before a cure can finally be brought about.

CHAPTER XIX.

ANÆSTHETICS, OR THE MEANS OF AVERTING PAIN.

The prevention of pain in surgical operations has been an object of anxious solicitude with practitioners from time immemorial, and we accordingly find that suggestions, more or less plausible, have been made at different periods with a view of meeting this important end. One of the most remarkable of these suggestions, inasmuch as it was a clear foreshadowing of the anæsthetics of the present day, occurs in the surgical writing of Theodoric, in the latter part of the thirteenth century. The means recommended by him consisted in thoroughly impregnating a sponge with a strong aqueous extract of various anodyne articles, especially opium, hemlock, hyoscyamus, lettuce, and mandragora, and then, after having been immersed for an hour in warm water, holding it to the nose until the patient fell asleep, when the operation was proceeded with. In order to rouse him when the operation was over, another sponge, dipped in vinegar, took the place of the "spongia somnifera," as the former was denominated; if this expedient failed, the juice of the root of fenugreek was freely injected into the nostrils. In India, the extract of the hemp plant, cannabis Indica, indigenous to that country, has been employed for the same purpose for ages past. Near the close of the last century, great hopes were entertained that a successful agent had at length been found in the inhalation of nitrous oxide gas, either alone, or variously combined with other vapors, but after numerous experiments, in which Sir Humphrey Davy and other eminent philosophers took an active part, the project was at length abandoned as chimerical. Some time prior to this period, Mr. Moore, of London, had suggested the possibility of diminishing pain in surgical operations, especially in amputations, by compression of the principal nerves, by means of an instrument, somewhat similar to a tourniquet, but so constructed as to touch the limb only at two points, one of the pads being regulated by a screw. The experiment was tried at St. George's Hospital, by Mr. John Hunter, upon a man whose leg was cut off below the knee on account of a large irritable ulcer of the foot, and the suffering is said to have been exceedingly slight. Very few, however, seemed inclined to repeat it, and the consequence was that it was soon given up; a result which might have been anticipated by the originator of the plan, as the instrument used for the compression was not only uncertain in its operation but productive of great uneasiness during its application.

In 1819, Mr. James Wardrop, of London, proposed to diminish the sensibility of the patient in surgical operations by means of copious

venesection, and in a paper which he published on the subject in the tenth volume of the Medico-Chirurgical Transactions he cites several cases illustrative of its beneficial influence. He thought the practice particularly adapted to persons of a nervous, irritable temperament, and he recommended that it should be carried to the extent of syncope, so as completely to annul all sensation during the dissection. In one of his cases, he bled the patient, a young, robust woman, to fifty ounces before he began the operation, which consisted in the extirpation of a small tumor from the orbitar plate of the frontal bone, during which she remained perfectly unconscious, expressing great surprise when she found it was over. As might have been expected, however, she remained very weak for several days after the operation, although she made a rapid recovery. I am not aware that this recommendation met with any particular favor.

The administration of the different preparations of opium for the purpose of lessening the pain of surgical operations is an old practice, highly lauded by some, and as greatly condemned by others. I was myself in the habit of employing it for many years in almost every case that fell into my hands previously to the discovery of anæsthetics; I generally preferred morphia to laudanum or opium in substance, and always gave it in full doses, either alone, or, when the patient was strong and plethoric, combined with a moderate quantity of tartrate of antimony and potassa, with a view of inducing a greater degree of relaxation and insensibility. I became very fond of the practice, and never, so far as I could determine, experienced any bad effects from it; on the contrary, I know that it was commonly productive of great benefit, not only blunting sensibility but preventing shock, and, consequently, severe reaction.

Notwithstanding these various attempts to prevent suffering in surgical operations, no anæsthetic agent, using the term in its legitimate sense, was discovered until 1844, when Dr. Horace Wells, a dentist of Hartford, Connecticut, wishing to have a tooth extracted, rendered himself completely insensible by inhaling nitrous oxide gas; and he soon afterwards administered the same remedy to several of his patients with effects equally gratifying. Shortly after this, Dr. Wells repeated his experiments before the Medical Faculty and Students of Harvard University at Boston, but owing to mismanagement either in the apparatus or in the gas itself, the attempt signally failed, and the only reward which he received for his pains was ridicule, which, in his case, was the more cruel, because he was a man of uncommon sensibility. Two years after this, Dr. Morton, also a dentist, who had been a pupil of Wells, resorted to the inhalation of sulphuric ether, first in his own person, and afterwards in some of his patients, until he became convinced that it might be taken not only with impunity, but with the most perfect certainty of preventing pain in any operation, however severe or protracted. Fortified with this knowledge, he applied at the Massachusetts General Hospital, at Boston, for permission to repeat his experiments upon a man who was about to undergo an operation for the removal of a tumor of the neck by Dr. John C. Warren. The result was everything that could have been

desired. The next day, Morton etherized a patient for Dr. Hayward; and the news of the remedy rapidly spreading, its use soon became general, both in the United States and in Europe. In the latter country, the subject attracted perhaps even greater attention than at home, and soon led to the discovery of chloroform by Dr. Simpson, of Edinburgh, in 1847. Various other articles possess anæsthetic properties; of this description are chloride of hydrocarbon, nitrate of ethyl, aldehyd, benzin, the Dutch liquid—a compound of chlorine and olefiant gas—bisulphuret of carbon, and amylen; but, with the exception of the latter, it is questionable whether any of them are sufficiently innocuous to justify their exhibition.

Practically it is of no importance to know who the discoverer of anæsthetics was; but, if we carefully inquire into the history of the matter, we cannot fail to award to Dr. Wells the credit of having made the first successful application of this class of agents for the prevention of pain during a surgical operation. Nearly fifty years previously, Sir Humphrey Davy had, it is true, employed nitrous oxide gas for the relief of a severe headache, brought on by the intoxication caused by the rapid drinking of a bottle of wine for experimental purposes, and afterwards as a means of preventing the pain of cutting a wisdom tooth; but, as every one knows, no further use was made of the remedy, until it was resumed by Dr. Wells, and applied with express reference to the production of its anæsthetic effects. He was beyond doubt the first to establish the possibility of preventing pain in surgical operations; and had his experiments at Boston not eventuated in chagrin and disappointment, he would unquestionably have pushed his researches much farther, and perhaps speedily hit upon the very articles which were afterwards found by Dr. Morton and Professor Simpson to possess such valuable properties. To both the latter gentlemen the world owes an immense debt of gratitude for having brought to light the wonderful anæsthetic effects of ether and chloroform; and our only regret, in connection with this subject, is that the former should have forfeited all claim to our respect and admiration by attempting to patent a remedy, the free use of which should have been open to every one from the commencement.

It is somewhat singular that the two countries in which the anæsthetic virtues of ether and chloroform were discovered should each, respectively, prefer its own remedy; America, ether, and Great Britain chloroform. There are, however, in the United States, numerous practitioners who prefer the latter article, both in surgical and obstetrical practice, and I have myself constantly used it ever since its introduction among us in 1848, believing it to possess decided advantages over ether, although its administration unquestionably requires greater care and attention. Among the more important of these advantages are, first, the more rapid manifestation of the anæsthetic action of the remedy, the system becoming affected much sooner, as a general rule, than it does by ether; secondly, a smaller amount of laryngeal and bronchial irritation; thirdly, the more easy maintenance of the anæsthetic influence, after the system has once been fairly affected; and, lastly, the less liability to cause vomiting and other

unpleasant consequences. The very odor of ether is to many persons excessively offensive, and there are very few in whom the inhalation does not produce more or less cough and vomiting. On the other hand, it certainly requires less caution in its administration, and thus far it has furnished but few deaths, whereas the mortality from chloroform already reaches about a hundred. Dr. Maddin, of Nashville, who has carefully investigated the subject, finds that most of the fatal cases of anæsthesia have occurred in minor surgery, or in operations of a comparatively trifling nature, and in which, consequently, the remedy might probably have been entirely dispensed with. For a number of these cases the dentist is accountable, nearly all the earlier and not a few also of the later having happened during the extraction of teeth, probably from the want of precaution in not sufficiently depressing the head during the operation.

It is remarkable that most of the fatal cases have happened in private practice, or in small institutions, a circumstance which would seem to show that there had been some fault in the mode of administration of the remedy. At Guy's Hospital, London, chloroform had been used in upwards of 12,000 cases before there was any serious accident; and in the war in the Crimea, according to the testimony of Mons. Flourens, it was administered more than 25,000 times without a single death. It has been asserted by the opponents of chloroform that the rate of mortality in the great operations of surgery has been essentially increased since the introduction of that article into practice, and Mr. Arnott, of London, has taken pains to collect elaborate statistics with a view of establishing the fact upon an irrefragable basis. On the other hand, the statistics of Dr. Simpson, the discoverer of the anæsthetic properties of chloroform, go to show that the number of deaths is not only not increased, but absolutely diminished. Perhaps the truth lies between these two statements. Dr. Macleod, in his Notes on the Surgery of the War in the Crimea, recently published, declares it as his conscientious belief that the use of chloroform in the British army saved many lives, and that numerous operations were performed by its assistance which could not otherwise have been attempted. It is not improbable that, if there has really been an increase in the mortality after operations since the introduction of anæsthetics, it has been owing, not to the pernicious effects of the remedy, but to the fact that surgeons have been emboldened to undertake operations in cases which were formerly regarded as unfit for the employment of the knife, and, above all, to the circumstance that of late years there has been a fearful increase of railway and other terrible accidents, many of which are necessarily fatal, no matter to what treatment they may be subjected.

I have now given chloroform for more than ten years, and during all that time no serious accident has befallen me. There was one case, however, in which I experienced much alarm; the patient was a boy, thirteen years of age, who was about to undergo an operation for the repair of his lips and cheek, which had been much mutilated by salivation. He took chloroform very badly, and had tried my patience for an unusual length of time, when, determined to make him inhale

more rapidly, I began my incisions. Instantly his struggles became furious, compelling me to suspend further proceedings. Provoked at the occurrence, I requested the assistant to hold the sponge closely over the nose, while I carefully watched the pulse and respiration. Fifteen seconds had hardly elapsed, when they both ceased, the face assuming at the same time a pale, livid aspect, too clearly denotive of asphyxia. In an instant the boy was turned upon his side, and artificial respiration instituted; cold water was dashed upon his body, and a free access of cold air invited by raising the windows of the apartment. Animation was speedily re-established, and the operation proceeded with, chloroform being again given towards its close, but of course with great caution. In this case it is evident that the patient was on the very verge of dissolution; but whose fault was it? Certainly not that of the chloroform, but the manner in which it was administered.

I ascribe my good luck in the use of chloroform to the great caution with which, except in the above case, it has always been given in my practice, and to the purity of the article employed by me. During my residence at Louisville, Dr. D. D. Thomson, for many years, superintended the inhalation in almost every important operation that I performed, either in private or public, and when he was not present, I either gave it myself or confided the task to a trustworthy assistant.

Anæsthetics not only prevent pain and thus save a vast amount of suffering, but by placing the patient in a passive condition give the surgeon a control over him which he could not possibly obtain in any other manner. Deprived of sensibility and consciousness, the former is virtually dead to all external impressions, and the latter is therefore enabled to conduct his dissections and other manual processes with as much ease and deliberation as if he were operating upon the cadaver. The advantages thus gained are absolutely incalculable, and he who would fully appreciate them must be able to put himself in the twofold situation of patient and surgeon, and then, in imagination, contrast their condition with that of the patient and surgeon of former times, before the discovery of anæsthetics, when the one was writhing in pain and agony during a tedious dissection, and the other had his progress incessantly interrupted by the cries and struggles of the sufferer.

The exhibition of anæsthetics is important not merely as a preventive of pain, but as a means which enables us to examine our cases more thoroughly prior to operation. Sounding for stone in the bladder, formerly a source of so much suffering, may now be performed without the slightest uneasiness, and the same is true of stricture of the urethra, diseased bones, affections of the anus and rectum, and of various other lesions. The use of anæsthetics affords immense advantages in the examination of dislocations and fractures, enabling us to handle the parts more satisfactorily than formerly, and therefore often leading to a much more certain diagnosis.

There are some operations in which the use of anæsthetics is usually regarded as inadmissible; thus, in harelip, excision of the tongue, and removal of the jaw, the patient, as a general rule, should be under the

influence of these remedies only at the beginning of the operation; after the dissection has been fairly commenced, he should be sufficiently conscious to enable him to co-operate with the surgeon, otherwise the blood, passing down into the windpipe, might cause severe cough and other inconvenience, seriously embarrassing the procedure. The same remark applies to excision of the tonsils, although I have frequently removed these organs while the patient was so far under the influence of chloroform as to render him incapable of offering any resistance. Extirpation of the jaws, I have repeatedly performed under similar circumstances, passing through the different stages of the operation while the person was in a state of perfect unconsciousness. Even the more delicate operations upon the eye, as the establishment of an artificial pupil, and the extraction of cataract, may be safely performed with the aid of anæsthetics; as it respects the latter, however, it should not be forgotten that the vomiting which occasionally attends their use might destroy the organ.

An advantage which has often been claimed for anæsthetics is that there is apt to be less hemorrhage during operations; I am, however, in doubt whether this is true, and, even if it were, any good that might thus accrue would be more than counterbalanced by the liability to secondary bleeding, caused apparently by a partial loss of tone in the smaller vessels, interfering with the formation of protective clots. Possibly the blood itself may be more or less at fault.

Chloroform, a terchloride of formyl, is a clear, colorless liquid, very volatile, of an agreeable, aromatic odor, of a pungent, saccharine taste, very dense, of the specific gravity of 1.497, almost insoluble in water, non-inflammable, and perfectly neutral, neither reddening nor bleaching litmus paper. It is a compound of two atoms of carbon, one of hydrogen, and three of chlorine. Various impurities are liable to be mixed up with it, especially the chlorinated pyrogenous oils, ether, and alcohol. The presence of oils is readily detected by pure, strong sulphuric acid, to which they impart a change of color, varying from yellowish to reddish brown, according to the quantity of the extraneous substances. A still more simple test consists in pouring the suspected fluid upon the hand, where, rapidly evaporating, it deposits its oily impurities, which are easily recognizable by their offensive smell. Dropped upon white paper, pure chloroform speedily disappears without leaving any stain. The existence of alcohol is detected by dropping a small quantity of chloroform into distilled water; if pure, it will retain its transparency at the bottom of the glass, whereas, if the reverse be the case, each globule will acquire a milky appearance. The presence of ether may be detected by a lighted taper, or the inflammable character of the fluid. It is practically important to know that chloroform deteriorates by exposure to heat and to a strong light. The most reliable article is that prepared with methylated spirit.

Mode of Administration.—There are five principal circumstances which should be closely attended to during the exhibition of chloroform, and if this be done it will be difficult, unless the article be a bad one, or the patient have some idiosyncrasy, to produce any unpleasant effects with it. These are recumbency, an empty state of the stomach,

a free play of the diaphragm, an abundance of atmospheric air, and a gradual administration.

1st. During etherization the patient may sit up with impunity, but this is not the case during the inhalation of chloroform, owing, apparently, to the greater relaxation of the muscles, and, consequently, to the greater difficulty in maintaining the circulation of the brain through the influence of the heart's action. Not only should the body be recumbent, but care should be taken to depress the head and shoulders, bringing them nearly to a level with the trunk.

2d. An empty state of the stomach is desirable for two reasons; first, because if chloroform be given soon after a hearty meal it will be almost certain to induce vomiting; and, secondly, because a crowded condition of the organ interferes materially with the movements of the diaphragm. Food must not be taken for at least four hours before the exhibition; but, on the other hand, the interval should not be too protracted, lest serious exhaustion result from the want of the necessary stimulus.

3d. Care must be taken, before the inhalation is commenced, that the patient's clothes are sufficiently loose to prevent constriction of the chest and abdomen. Any compression from this source would necessarily impede the action of the diaphragm, and might thus become a cause of mischief.

4th. The importance of having an abundance of atmospheric air during the inhalation of an article so potent as chloroform, is self-evident; in etherization this is of comparatively little consequence, but in the exhibition of chloroform for surgical and obstetrical purposes, it is absolutely indispensable to the safety of the patient.

5th. The inhalation must be effected gradually, not hurriedly, time being allowed to the system to accommodate itself to the influence of the remedy, thus avoiding the shock which might otherwise result to the heart and brain. From six to eight minutes should usually be spent in producing the full effects of the anæsthetic.

When the patient is very feeble, or pale and timid, it will be advisable to give him, immediately before the operation, from half an ounce to an ounce of brandy; and the dose may afterwards be repeated, if the effect is obliged to be maintained for an unusual length of time, sufficient consciousness being permitted for the performance of deglutition.

The best mode of administering chloroform is to pour the fluid upon a napkin or handkerchief, previously folded into a kind of cup-shaped hollow, and held securely in the hand. Or, instead of this, a small, hollow sponge may be used. As to the various inhalers that have been devised for the purpose, they are all objectionable on account of their inconvenience and the difficulty of obtaining a sufficiency of atmospheric air. The patient having taken his place upon the table, and emptied his lungs by a deep and protracted expiration, the napkin, impregnated with a drachm of chloroform, is held over the mouth and nose, at a distance of about two inches, being gradually brought nearer and nearer until it is within half an inch, beyond which it should not be carried, the chest being at the same time regu-

larly and powerfully distended. On no account should the liquid be permitted to come in contact with the surface, as it might thus cause vesication. All unnecessary conversation is avoided, lest the attention of the patient should thereby be unduly distracted. The assistant having charge of the administration gives it his earnest and undivided care; wetting the napkin from time to time with the fluid, and seeing that the patient gets an abundance of air, his vigilance increasing as the effects of the medicine become more and more apparent. As soon as the sensibility is completely abolished, the operation is commenced, a return to consciousness being prevented by holding the napkin, wet with a small quantity of the vapor, occasionally before the nose, and thus the impression is maintained, steadily and cautiously, not only until the knife has fully accomplished its object, but until the principal arteries have been secured, and, in some cases, even until the dressings have been applied.

As soon as the inhalation has been fairly entered upon, one of the attendants should sedulously watch the state of the pulse, of the respiration, and of the countenance. Any sudden failure in any one of these should at once create alarm, and induce a suspension of the operation, or provision for the admission of a greater quantity of atmospheric air. I do not deem it necessary that a finger should be constantly kept upon the pulse; for the color of the face and the nature of the breathing will always sufficiently indicate the effects which the anæsthetic is exerting upon the system, and thus afford abundant opportunity for preventing any unpleasant occurrence.

The *quantity* of chloroform required during an operation, and the time during which its effects may be safely maintained, must, of course, vary according to the exigencies of each particular case. In general, from half an ounce to an ounce may be regarded as a fair average, but very frequently it takes three or even five times that amount, depending upon the severity and duration of the operation, and the susceptibility of the individual. In some instances almost an incredibly small portion answers the purpose. Children usually require comparatively little; and it is well known that women are, as a general rule, more susceptible to its influence than men. Persons exhausted by hemorrhage are very easily affected by it, owing to the rapidity of its absorption, and hence it should always be administered to them with unusual care. In obstetric practice, the effects of chloroform may be maintained, with impunity, for many hours together, and the same remark is true of severe and tedious surgical operations. Thus, in an attempt to reduce a chronic dislocation of the shoulder joint, I kept the patient steadily under the influence of the remedy for two hours, during which time not less than twenty ounces were given.

Age is no bar to the use of anæsthetics. I have given chloroform repeatedly to very young children, and, in one instance, I administered it, with excellent effect, to an infant under two months. Old persons also bear the inhalation well. Certain diseases are usually regarded as contra-indicating the employment of anæsthetics, particularly organic lesions of the heart and brain; but, for my own part, I have never allowed any affection whatever to stand in my way, and I can

really, upon general physiological principles, see no reason why they should, since, by tranquillizing the system, they effectually prevent the mental and bodily perturbation which is so apt to attend operations performed without the aid of these agents. In giving chloroform to infants and very young children, only a few drops should be poured upon the napkin at a time, and care should be taken to hold the cloth at a considerable distance from the mouth and nose, so that the fluid may enter the lungs well diluted with atmospheric air.

Effects.—The effects of chloroform upon the system may, for practical purposes, be divided into two stages, namely, that of excitement, and that of insensibility. The first begins soon after the commencement of the inhalation, and is characterized by various cries and struggles, as if the patient, feeling alarmed, were anxious to escape from the table. The face becomes flushed, the eye has a wild and staring expression, the pulse is preternaturally frequent, and the mind is incoherent; as the effects increase, the brain falls into a species of exhilaration closely akin to that of intoxication. It is now that the individual usually exhibits his peculiarities of temperament and habit. Thus, if he be of a boisterous disposition, he will be very apt to be noisy, to swear, or to fight, and to make the most violent efforts to disengage himself from the assistants. One man will laugh and joke; another will weep, or moan and sigh; the sportsman will fancy himself occupied in the pleasures of the chase; the wily craftsman in driving a good bargain; the lawyer in addressing a jury; the preacher in exhorting his congregation; and the physician in prescribing for his patient. The mind is in a dreamy, perverted condition, and whatever is most predominant at the time in thought and feeling is sure to exhibit itself in expression.

This excitement varies much both in degree and duration; in many cases it is very slight and transient, while in some it is even entirely wanting, the patient being perfectly tranquil throughout. When considerable, it is very liable to be reproduced, to a greater or less extent, as the effects of the remedy wear off, so that the individual will perhaps be quite as boisterous after the inhalation is over as he was soon after its commencement. In very nervous, excitable persons the intoxication may last for several hours, although this is uncommon.

In the second stage, which succeeds imperceptibly to the first, the individual gradually lapses into a state of entire unconsciousness; the muscles, thoroughly relaxed, are no longer under the control of the will, the limbs retaining any position in which they may be placed; the eyelids are closed and the balls turned up, the pupils being contracted, and insensible to light; the respiration is calm and easy; and the pulse is soft and undisturbed, or, if it be at all changed, it is rather below than above the normal frequency. Feeling and intellection are suspended, and everything indicates that the patient is in a quiet and pleasant sleep, wholly unconscious of surrounding objects, and therefore completely insensible to pain. If this state be carried a little farther, coma will arise; the patient will snore as if he were apoplectic, the pulse and respiration will diminish in force and frequency, and the pupil will become notably dilated. As yet, all is safe, but a

few more whiffs, and an important link in the chain of life may give way, and the patient be sent into eternity. In the administration of chloroform we should always strive to prevent coma. The most unexceptionable form of anæsthetization unquestionably is that in which there is a perfect suspension of sensibility without the complete abolition of consciousness; but it need hardly be added that it is, practically, extremely difficult to produce such a nice result in any case. In general, the patient, on recovering from the effects of the remedy, has no distinct recollection of anything that passed while he was under its influence.

The effects of chloroform seldom completely disappear under several hours. After the more characteristic symptoms have gone off, the mind will still remain somewhat bewildered, the muscles relaxed, and the feelings perverted. In some cases, especially in children, the patient, after having passed through a most severe operation, will fall into a tranquil sleep, and perhaps not wake up fully for an hour or two. In other cases, again, the effects will go off very rapidly, and the individual will not only be roused to a state of consciousness but to severe pain. If the vapor has been inhaled largely, there will frequently be some degree of nausea or even vomiting, either during the operation, or at its close, upon the return of consciousness. Emesis is most frequent in children and in persons of a nervous, irritable temperament. Headache, although not common, is occasionally met with, and sometimes lasts for a number of hours. It is most liable to come on if the chloroform is impure.

Chloroform, inhaled to excess, sometimes produces effects which disappear only after a considerable length of time; as abolition of the sense of smell, perversion of taste, and loss of power in the bladder and rectum. In two cases, observed by Dr. Happoldt, of South Carolina, these effects did not completely wear off for two months.

Although chloroform is one of the greatest boons which a kind and beneficent Providence has bestowed upon man for the prevention and alleviation of pain, yet, like every other remedy, it is capable, when abused, or injudiciously administered, of producing the most deadly effects. These effects are those of a narcotic poison; and as they may follow, in persons of unusual susceptibility, the inhalation of the smallest quantity of the liquid, it is of the utmost importance that they should never, for a moment, be lost sight of in the use of the article. An over-dose may destroy life almost instantaneously, or death may occur at a variable period after the exhibition; sometimes after partial reaction has taken place. The phenomena indicative of danger are, stertorous respiration, a small and feeble pulse, lividity of the features, dilatation of the pupils, relaxation of the sphincters, and rapid diminution of the temperature of the body. It seems probable, although the question does not admit of positive adjudication, that these effects are mainly, if not wholly, due to the action of the carbonic acid gas contained in the chloroform primarily upon the blood and nervous centres, and secondarily upon the respiratory organs, thereby disqualifying them for the performance of their functions, death being caused by asphyxia. What corroborates this view

of the subject is the fact that the danger from the inhalation of chloroform is generally in proportion to the impurity of the article, or the quantity of its pyrogenous oils, and the want of a sufficiency of atmospheric air, or the most essential constituent of this fluid, namely, oxygen, during the administration of the remedy.

The *treatment* for the relief of the poisoning consequent upon an over-dose of chloroform must be prompt and efficient; for everything depends upon the presence of mind of the surgeon and the rapidity and energy with which he applies his remedies. The first thing to be done is to desist from the further administration of the remedy; the second to draw the tongue out of the mouth with a tenaculum, so as to lift it away from the glottis; the third, to cause a full access of cold air, by throwing open the doors and windows of the apartment, and making free use of the fan; the fourth, to dash cold water upon the body, or, still better, to pour it from a height of several feet; the fifth, to institute artificial respiration, by introducing a tube into the windpipe, and percussing the body or by blowing air into the mouth; the sixth, to stimulate the surface, especially over the spine and heart, with hot mustard water, or dilute spirits of hartshorn; the seventh, to administer an injection of turpentine; and the last, to apply galvanic electricity, passed through needles inserted in different parts of the body. As soon as the patient is able to swallow, free use is made of brandy and ammonia. These means should be employed with great diligence and regularity until it is perfectly evident that life is irrecoverably extinct.

For the minor effects of chloroform very little is necessary, beyond a discontinuance of the inhalation, sprinkling the face and chest with cold water, allowing a free access of cold air, and holding a smelling bottle near the nose, but not to it. If vomiting occur, the patient must immediately be turned upon his side—not on his abdomen, lest the action of the diaphragm be impeded—with the head inclining downwards, otherwise the contents of the stomach, as they are lazily ejected from the œsophagus and fauces, might easily descend into the larynx, and thus induce suffocation.

I cannot conclude these remarks upon the subject of anæsthetics without expressing a hope that practitioners of every description will cease to administer these remedies to females without the presence of witnesses. The cases of the two dentists, the one of this city and the other of Montreal, which have lately created so much excitement both in and out of the profession, should serve to inculcate proper caution in this particular, without which no man's reputation and character, however pure or exalted, may altogether escape censure, if, indeed, ruin. The remarkable instance which, a few years ago, occurred at the Philadelphia Hospital, of a woman who, while under the influence of anæsthesia, went through all the movements of the sexual congress, and analogous examples reported in the medical journals, clearly show how strongly the imagination of the patient may be impressed in this way, while thus affected, and how vividly the idea may remain after the effects of the remedy have passed off. The case that occurred, not long ago, at Louisville, might have been followed by a vexatious and

disgraceful law suit, if it had not fortunately been witnessed by several medical gentlemen. Practitioners should take care of their character not less than of the lives of their patients.

Inhalation of Ether.—The inhalation of ether is best effected by means of a large hollow sponge held closely over the nose and mouth, although a folded napkin will be found to answer the purpose sufficiently well. No special attention need be paid to the admission of atmospheric air, as this fluid possesses none of the poisonous qualities of chloroform and other kindred articles. Not less than half an ounce should be poured upon the sponge at a time, and the administration should be diligently maintained until a full anæsthetic effect is produced, which usually requires a considerably longer period than in the case of chloroform. At first a short cough is generally provoked, but this soon subsides, and the system gradually lapses into a calm, quiet condition, attended with muscular relaxation, closure of the eyelids, and mental unconsciousness, followed, in many cases, by stertorous respiration.

The quantity of ether consumed in an ordinary operation is seldom less than from four to eight ounces, while in the more protracted cases twice or even thrice that amount may be necessary. Sickness and vomiting are common effects of the use of this agent, and there is also not unfrequently a great deal of headache after the patient has recovered from his unconsciousness, sometimes lasting upwards of twenty-four hours. In administering chloroform the patient always lies down; in etherization, on the contrary, he may sit up, or be recumbent, as may be most convenient to the operator, no injury resulting even from the protracted maintenance of the erect position. The inhalation too may be carried on more rapidly, and, as already stated, without any special reference to the admixture of atmospheric air, a sufficiency always entering through the sponge. Any bad effects that may arise from etherization should be treated upon the same general principles as those produced by an over-dose of chloroform. The cold douche in particular will be of much service in recalling the patient to consciousness. All the different varieties of ether possess anæsthetic properties; but the one universally preferred is the sulphuric, thoroughly washed, and divested of impurities. It is the article which Dr. Morton originally introduced to the notice of the profession under the name of letheon, or pain-destroyer, and which is now so much employed in surgical and midwifery practice in this country.

Some practitioners prefer a mixture of ether and chloroform to either of these articles alone, considering it as equally efficient, and at the same time more safe. I have myself frequently employed them in this way, and regard the combination as unobjectionable in every respect. The ordinary proportion is three parts of sulphuric ether to one of chloroform; but the quantity of either agent may be increased or diminished, according to the exigencies of the case, or the whim, fancy, or caprice of the surgeon. A mixture, composed of equal parts of chloroform and alcohol, was recommended by Dr. Snow, and is generally regarded as a very safe and efficient anæsthetic. In ad-

ministering it to very young children, it may be diluted with rectified spirits, although, if proper care be taken, this is not at all essential, either to safety or convenience.

Amylin.—With amylin, as an anæsthetic agent, I have no experience. The article has seldom been employed either in Europe or in this country, and future observation must determine its merits and the degree of confidence to be reposed in it. It has been condemned by the Academy of Medicine of Paris, as too hazardous for inhalation; and it is well known that two fatal cases occurred from its exhibition in the hands of Dr. Snow, soon after he introduced the remedy to the notice of the profession in 1856, and after he had administered it successfully in one hundred and forty-three cases. He was inclined to believe that it occasioned death by inducing paralysis of the heart. It produces anæsthesia more rapidly and in smaller quantity than chloroform, at the same time that it is less liable to cause vomiting, coughing, struggling, muscular rigidity, or profound coma. The patient generally wakes up from its effects in a few minutes after the discontinuance of its use. The same care should be exercised in its exhibition as in that of chloroform.

Local Anæsthesia.—Various plans have been tried for the purpose of inducing local anæsthesia, but the results have not been such as to hold out much encouragement for their practical application. When we consider the absorbent powers of the skin, it might reasonably be supposed that the endermic use of the more potent anodynes, as opium and its different preparations, aconite, belladonna, hyoscyamus, and other kindred articles might be employed beneficially in this wise, but experience has proved that any effect of this kind that they may possess is exceedingly transient and altogether incapable of serving as a preventive of pain during the application of the knife. The employment of ice, or frigorific mixtures, recommended by Mr. James Arnott, of London, is hardly entitled to more confidence; my experience with it is, it is true, very limited, but I have seen enough of it to satisfy myself that its value has been greatly overrated by its best advocates, and it can never, except, perhaps, in the most trivial cases of injury and disease, be carried to a sufficient extent to prevent pain in surgical operations. I tried it on one occasion upon an old lady during the removal of the mammary gland; and, although the skin and subcutaneous cellular tissue were partially congealed, the ice in the latter producing a crackling noise, yet she suffered most severely, especially during the dissection of the deeper structures, where the effects of the freezing mixture had evidently not penetrated. No one can deny that, in this case, the remedy had not been carried to a sufficient extent, and yet it certainly exercised but a very feeble influence as an anæsthetic. Besides, the application is not without risk, as the part, if not carefully watched, may be frost-bitten, and thus occasion unpleasant secondary effects.

Mr. Arnott's freezing mixture consists of two parts of ice and one of common salt, the former being previously reduced to a fine powder in a canvas bag, pounded with a flat-iron. The latter should also be pulverized. The two articles are then thoroughly and quickly mixed,

either with a knife, or by stirring them together in a gutta percha or other non-conducting vessel. The mixture is now inclosed in thin gauze netting, and as soon as the action of the salt upon the ice is rendered apparent by the dripping of the brine, it is placed upon the part to be benumbed, which is held in a horizontal position during the application. The netting should occasionally be raised to watch and equalize the effect of the remedy. About a quarter of a pound of ice and half that quantity of salt suffice for an ordinary application.

The first effect of the remedy is to chill the part, but this rapidly disappears, and is succeeded by pallor of the surface and a sense of numbness. Very soon the skin is found to be notably shrunken, and to assume a deadly, tallow-like appearance, at the same time that it is rendered somewhat stiff and perfectly insensible. If the application be continued longer, the subcutaneous cellular and fatty tissues become partially congealed, as is proved by the fact that they feel hard, and crackle slightly under the finger. When the application is properly made, that is, gradually and cautiously, the netting being occasionally raised for the purpose of inspection, it is perfectly harmless and almost free from suffering. It is only when it is continued too long that it is likely to be productive of mischief. Ordinarily from fifteen minutes to half an hour will be required to afford the desired anæsthetic effect.

PART SECOND.

SPECIAL SURGERY;

OR,

DISEASES AND INJURIES

OF

PARTICULAR ORGANS, TEXTURES, AND REGIONS.

PART SECOND.

SPECIAL SURGERY; OR, DISEASES AND INJURIES OF PARTICULAR ORGANS, TEXTURES, AND REGIONS.

CHAPTER I.

DISEASES AND INJURIES OF THE SKIN AND CELLULO-ADIPOSE TISSUE.

SECT. I.—ERYSIPELAS.

Erysipelas is so frequent and formidable an occurrence that every practitioner should be perfectly familiar with its nature and symptoms. Produced by various causes, both local and constitutional, it may exist as a primary affection, or show itself as a complication of other lesions, modifying their character, interfering with their evolution, and even, at times, entirely supplanting them. Observed from time immemorial, it is distinctly mentioned by Hippocrates, and has been a subject of particular investigation in the present century, as is evinced by the numerous papers and monographs that have been published respecting it during the last fifty years. The names and titles alone of these productions would fill many pages.

Erysipelas was at one time supposed to be peculiar to the skin and cellular tissue, but this is not the fact, modern researches having shown that it is liable to attack various other structures, particularly the mucous and serous. By dermatologists this affection is usually ranked among the exanthematous diseases, on account of the discoloration which forms so striking a feature in its symptomatology. The term by which it is commonly designated is a Greek compound, signifying to spread.

The disease is generally arranged under different heads, according to the symptoms which attend it, or the parts of the body which it implicates. Thus, there may be erysipelas of the head, face, trunk, genital organs, and extremities. The most common, as well as the most proper, division, however, is into simple, phlegmonous, and œdematous. To this some authors have added a fourth, namely, the gangrenous. To such an arrangement no valid objection can be made, provided it be borne in mind that it is altogether artificial, and that it is intended to denote merely a difference in the degree, but not in

the kind, of the morbid action. There is reason to believe that this distinction has not been sufficiently heeded in practice. Erysipelas is said to be idiopathic or traumatic, according as it depends upon some constitutional vice, or upon external injury.

The malady occurs at all periods of life, and in both *sexes*, but in what ratio has not been ascertained. The idiopathic variety is perhaps most common in women, the traumatic in men, owing to the greater liability of the latter to all kinds of injury.

There are no facts to show that *temperament* exerts any influence in the production of this disease. Bilious, or bilio-sanguineous, and nervous, irritable persons are said to be most prone to it; but in what proportion, or for what reason, remains to be determined. The malady is more frequent, at least in America, in the latter part of autumn, in winter, and early in the spring than at any other season of the year, not a day of which, however, is anywhere exempt from its invasion in either of its two forms. Locality, doubtless, exerts an important influence in its causation; it is well known that it is particularly liable to occur in the narrow, crowded, and filthy streets of large cities, in the confined and ill-ventilated wards of hospitals, and in marshy, malarious districts. The effect of occupation in producing erysipelas has not been determined; but there is no question that cooks, blacksmiths, foundrymen, and persons habitually exposed to dry heat are particularly obnoxious to its attacks.

No *region* of the body is exempt from this affection, though some are more liable to it than others. The idiopathic form is most frequent in the face, scalp, neck, and trunk, while the traumatic appears to be most common in the extremities, particularly the inferior. It has been observed by most writers that the eyelids, nose, and forehead are especially prone to be attacked; a fact for which it is impossible, in the existing state of the science, to assign any satisfactory reason. Old, decrepit subjects, and persons worn out by intemperance and disease often suffer from erysipelas of the scrotum, the vulva, feet and legs. In infants a very common seat of the disease is the lower part of the abdomen, around the umbilicus. Injuries of the scalp, tendons, and aponeuroses frequently give rise to erysipelas, and are liable, in consequence, to be followed, in many cases, by the worst results.

Erysipelas occasionally assumes an *epidemic* type. Hippocrates already observed this fact. During the middle ages a gangrenous erysipelas repeatedly ravaged France, where, from its excessive violence, the disease was called the plague of fire. In times of war erysipelas has occasionally prevailed as an endemic in camps, barracks, hospitals, and prisons. In modern times it has been observed in both of these forms in various localities. Dr. Gregory expresses the belief that there is not a single hospital in London which has not, occasionally, been visited by the endemic variety of the disease. At St. George's Hospital, in that city, he has repeatedly seen erysipelas so prevalent that all important surgical operations were obliged to be postponed for fear of the supervention of the malady. The inmates of the Hôtel-Dieu, of Paris, are frequently assailed in this way, and the mortality thence arising is said to be quite great. Calmiel states

that there are periods when erysipelas prevails so extensively in the lunatic asylums of the French metropolis that the physicians of those institutions are compelled to suspend all treatment by counter-irritants, as blisters, setons, issues, and moxas, because it is almost certain to be followed by an outbreak of this affection. Velpeau describes an epidemic erysipelas which prevailed at La Pitie in 1831. In 1844, '5, and '6, the disease was so common in the Louisville Hospital, and also throughout the city of Louisville, that I was obliged, on numerous occasions, to postpone the performance of all operations in which delay was admissible, for fear of giving rise to it. Such was the tendency, at that period, to its occurrence that the most trivial incision, the slightest puncture, and the most insignificant scratch were almost sure to be followed by an attack. For a long time we were obliged, in consequence of this proclivity, to refrain from the application of blisters and leeches, venesection, the introduction of setons, and the establishment of issues. Chancres, buboes, and common ulcers were often invaded in the same manner. But the epidemic was not confined to that city; it prevailed more or less extensively in different sections of the Union, and carried off an immense number of all classes of people. In many localities there was a marked connection between the affection and puerperal peritonitis, the latter of which proved very fatal.

The question as to the *contagiousness* of this disease is not fully settled. Much may be said both against and in favor of such a view. My own opinion, founded upon considerable experience, is that the affection, at times, possesses such a character. It is very well known that it is inoculable. Thus, a sponge impregnated with the matter of an erysipelatous sore will very readily communicate the disease to an ulcer or an abraded surface in a sound person, and the same thing is true of poultices, salves, and other dressings. Facts which show that the nurses and friends of individuals affected with erysipelas often contract the disease are of frequent occurrence. In this way whole families are sometimes cut down. A gentleman in Davies County, Kentucky, in 1852, lost his only son by this disease. A cousin and a female acquaintance who attended on him soon became ill with it, and both died; it then spread to other members of the family, producing serious ravages before it was finally arrested. In 1846, when erysipelas reigned as an epidemic at Louisville, a man was received into the Louisville Hospital with an ulcerated bubo, and about the same time a woman, who had been his mistress, was also admitted with the prevailing distemper. In consequence of an inability to obtain a female nurse, the man was permitted to attend upon her in that capacity. He soon cohabited with her; in a few days he became excessively ill, the sore in the groin assumed an erysipelatous aspect, and in less than a week from the time of his admission he died from the effects of the malady. In the wards of hospitals erysipelas often spreads from one person to another, and in private practice the disease, there is reason to believe, is occasionally carried by the physician from one house to another. In this way it is no doubt sometimes communicated by the accoucheur to parturient females.

Causes.—The causes of erysipelas are too numerous and diversified to admit of any very definite specification. As a general rule, it may be assumed that whatever has a tendency to disorder the digestive, hepatic, or, in short, any other important function, is capable of producing the disease. So true is this that there is seldom, if ever, a case of the complaint in which such derangement does not play a more or less conspicuous part. The fact is important, as leading to valuable therapeutic considerations. Certain articles of diet either predispose to or induce the malady. Thus, there are some persons who can never eat shell-fish or particular kinds of fruits, as strawberries, nuts, and similar substances, without suffering an attack. The retention of vitiated secretions and undigested food in the alimentary canal often lead to similar results. Derangement of the uterine function, suppression of the cutaneous perspiration, great mental excitement, the habitual use of ardent spirits, loss of sleep, hard study, inordinate sexual indulgence, and whatever else has a tendency to weaken the corporeal faculties, may be enumerated as so many causes of the disease. A vitiated state of the atmosphere, as is witnessed in hospitals and other charities, often powerfully predisposes to its attacks and its continuance.

Erysipelas frequently supervenes upon wounds, both accidental and artificial, interfering with the healing process, and, at times, seriously comprising both part and system. The period at which this occurs varies from twenty-four hours to several days, according to the nature and extent of the lesion, the presence or absence of complications, the habits of the patient, the condition of the system, and the state of the atmosphere. Lacerated, punctured, gunshot, and poisoned wounds are much more liable to be assailed in this manner than incised wounds, though the latter are by no means exempt from it, especially if they involve the scalp, hands or feet, or if they affect old, intemperate, or debilitated individuals.

When the disease is epidemic, it often shows itself within a very short time after the reception of an injury, however slight or insignificant. Under such circumstances, indeed, I have, as already stated, known it to follow upon the most trifling wound, scratch, or puncture, as a leech-bite, venesection, vaccination, or the application of a blister. Fractures, dislocations, sprains, contusions, and various other injuries not unfrequently give rise to it. Ulcers, whether common or specific, are often invaded by it, especially when the patients are of a broken-down constitution. Lying-in females are, in certain conditions of the atmosphere, particularly prone to suffer from erysipelas of the uterus and pelvic veins.

Finally, erysipelas frequently ingrafts itself upon other diseases. During the winter of 1857, when the malady was endemic in this city, a number of instances occurred where it supervened upon measles, scarlatina, and typhoid fever. During an outbreak of epidemic erysipelas in Louisville, in 1844, '5 and '6, every case of disease that was admitted into the public hospital of that city received its peculiar impress, and wore, for a time, its peculiar livery. When the affection was raging at its fullest height in the institution, many of the patients who were convalescing from other maladies were suddenly seized with

diarrhœa, pneumonia, and bronchitis, over which the usual remedies exercised no control, and which generally proved fatal in a few days.

When erysipelas supervenes upon wounds, its approach is usually denoted by an arrest of the adhesive process, by a tensive, burning sensation in the affected part, by a discharge of thin, sanious matter, or an entire suspension of secretion, and by an œdematous appearance of the surrounding structures. Finally, the characteristic blush occurs, and gradually diffusing itself often spreads over a considerable extent of surface.

When erysipelas seizes upon ulcers, as it may do at any time, whether they be benign or malignant, simple or specific, the local symptoms closely resemble those which characterize the complaint when it follows upon wounds and contusions. The granulations, if any exist, assume a pale, glossy, unhealthy aspect, the pus is replaced by a thin, ichorous fluid, the part is rendered uncommonly painful, and the edges of the sore, along with the adjacent surface, exhibit a reddish, œdematous appearance. In chancres and dissection wounds the presence of the malady is indicated by reddish, tender lines, formed by superficial lymphatic vessels, generally extending as high up as the neighboring ganglions, which, in turn, become swollen and exquisitely painful. The morbid action may, in both cases, be simple or phlegmonous, and is almost always dependent upon derangement of the digestive organs, or the suppression of some habitual discharge.

Erysipelas, consequent upon fractures and dislocations generally displays itself within the first forty-eight hours after the reception of the injury, and often spreads very rapidly over a large extent of surface, as the greater portion of a limb, one side of the trunk, or the whole scalp and face. The accident is particularly liable to supervene upon the compound forms of these lesions, and is always to be viewed with distrust, as it not unfrequently compromises the patient's recovery. Erysipelas of the scalp, caused by wounds, or fracture of the skull, generally appears from the second to the third day, and often proves dangerous by its extension to the brain and its envelops, through the intervascular communications between the pericranium and the dura mater. Such cases always demand the greatest vigilance on the part of the practitioner.

Varieties.—Erysipelas occurs under several varieties of form, as the simple, phlegmonous, and œdematous, each of which merits brief attention. To this division may be added erratic erysipelas, so called from its disposition to wander from one part to another.

The term *simple* is employed to designate that form of the disease which is confined exclusively to the skin. It manifests itself in a bright, vivid, almost scarlet discoloration of the skin, a pungent, smarting, or burning pain, and a sense of stiffness, with, perhaps, here and there a little vesicle, not larger than the head of a pin, and filled with a serous fluid. The swelling is very slight, and, unless the extent of disease is considerable, there is no particular constitutional disturbance. The attack is usually of short duration, and the subsidence of the local disease is always followed by a furfuraceous desquamation of the epidermis.

Phlegmonous erysipelas is a much more serious lesion than the simple, all the symptoms existing in a higher degree, and the disease often terminating in extensive suppuration, abscess, and even gangrene. The discoloration varies from scarlet to deep purple; there is extensive swelling; vesication soon arises; and the pain is of a violent, burning, tensive, and throbbing character, the part feeling heavy, stiff, numb, and as if it were on fire. The inflammation extends deeply into the different tissues, affecting skin, cellular substance, muscle, and, in short, everything that comes in its way. As it progresses, suppuration takes place, leading to the formation of extensive abscesses, and the destruction of large portions of the cellular and adipose tissues. If the morbid action be very intense, mortification will be apt to arise, its approach being indicated by the development of large blebs, filled with bloody or muddy serum, and by a dark, livid, brownish, or ash-colored appearance of the skin. The constitution sympathizes early and deeply, the symptoms being at first of a sthenic character, but soon becoming typhoid.

The *œdematous* variety depends entirely upon accidental circumstances, its name being derived from the circumstance of the parts being infiltrated with serosity, and, consequently, pitting under pressure. It is most commonly met with in the eyelids, scrotum, prepuce, vulva, and inferior extremities, in persons who are debilitated by previous disease, or who naturally possess a feeble constitution. The swelling is often considerable, but the discoloration and pain are comparatively trivial. The diseased surface has a glossy, distended appearance, and retains the mark of the finger for some time after it has been withdrawn. The inflammation is attended by constitutional disorder, generally of a typhoid character, and is apt to terminate in mortification rather than in abscess, though the latter is often present in the more severe cases.

Erratic erysipelas is characterized, as the name imports, by a disposition to extend from one point to another; it is most commonly met with on the face and forehead, from which it frequently spreads, on the one hand, to the hairy scalp, and, on the other, to the neck and ears. I recollect a case of this form of erysipelas, which, commencing on the left nates, finally extended over the whole trunk. The disease is generally superficial, and is characterized by an erythematous appearance of the surface, with pungent pain but little swelling.

If a *dissection* be made of a limb in a state of erysipelas, it will exhibit various appearances, according to the amount of the diseased action. In the milder grades, there will merely be some degree of induration of the skin, unusual distension of the vessels, and slight effusion of serum, or of serum and lymph, in the subjacent cellular substance. In the phlegmonous variety, there is generally extensive infiltration of the ordinary inflammatory products; the lymph has a spoiled and unnatural appearance, looking like lard or a mixture of flour and water; abscesses exist in various situations; the cellular tissue is converted into grayish, or ash-colored sloughs; and the muscles are extensively separated from each other. In a case which occurred in the Louisville Hospital in 1846, during the prevalence of

epidemic erysipelas, the abscess reached from the hip to the ankle, extensively detaching the muscles from each other and from the bones, which might have been lifted almost bodily from the diseased mass, so completely were they severed from their connections. Pure blood is sometimes extravasated in considerable quantity; and the matter, which varies much in its color and consistence, is often excessively offensive. Metastatic abscesses are occasionally found in the internal viscera, and effusions in the serous cavities.

An epidemic erysipelas, of a very singular character, prevailed in various sections of this country, from 1842 to 1847, its first appearance having been noticed in Vermont and New Hampshire. It had previously shown itself in Canada, and soon after it broke out in the southwestern States, where, as well as in other parts, it proved exceedingly fatal. In Louisville, where I then resided, it prevailed for several years, and afforded me an excellent opportunity of studying its character. It usually began in the throat and fauces, or simultaneously in these parts and upon the cranio-facial region, in the form of a deep red, glossy, œdematous swelling, which gradually extended until it involved the whole of the neighboring structures, the countenance being generally distorted in the most hideous manner, so that the patient could hardly be recognized even by his most intimate acquaintances. The tongue, uvula, and tonsils were enormously swollen, deglutition and breathing were extremely difficult, and death was often produced by suffocation. Delirium and excessive prostration were early and prominent symptoms, and many of the cases perished within the first five days. The disease remained generally confined to the parts originally affected. If the patient survived any time, profuse suppuration, and sometimes even extensive sloughing, occurred; abscesses formed in various regions of the body; and, after much suffering, the patient either recovered, or died from exhaustion. In some of the persons whom I attended there was extensive ulceration of the tonsils and arches of the palate; and, in several, complete destruction of the parotid gland of one side. In one case, almost the whole of the occipital bone was stripped of its pericranium. Dissection disclosed deep engorgement of the lungs, accompanied, in many cases, by inflammation of the bronchial tubes, and even of the pulmonary parenchyma, and by effusion of serum, or of serum and pus, in the pleura and arachnoid sac. The abdominal and pelvic viscera were generally sound, except in lying-in females, who usually exhibited high evidence of peritonitis, metritis, and phlebitis. In one instance, which occurred quite early in the epidemic, the immediate cause of death was a large metastatic abscess in the left lung, the erysipelas being seated in the corresponding leg.

The disease which I have thus briefly described was generally known in the west under the name of "black-tongue," "swelled head," or "erysipelatous fever." It seldom attacked any one under fifteen years, but from that period up it was indiscriminate in its selection of subjects. Females seemed to suffer quite as frequently as men. The poor and the intemperate were its most common victims.

Constitutional Symptoms.—Whatever form it may assume, erysipelas

is usually preceded by symptoms denotive of general indisposition, such as a feeling of *malaise*, or discomfort, creeping, chilly sensations, lassitude, pain in the head and limbs, impaired appetite, and an indisposition to exertion. After continuing in this state for a period varying from twenty-four to thirty-six hours, the disease declares itself in a more open manner. The patient is now suddenly seized with shivering, or violent rigors, followed by, or alternating with, excessive heat, and accompanied by severe cephalalgia, nausea, intense thirst, restlessness, and a great sense of muscular prostration. The tongue is dry and coated, the skin hot, the pulse strong and frequent, the urine high-colored and scanty. As the disease progresses, the system becomes more and more exhausted, the mind wanders, and the case soon assumes a typhoid character. Or, typhoid symptoms may be present almost from the very commencement, especially if the patient be old, or depressed by previous suffering. In the milder forms of erysipelas, there is often very little, if any, constitutional disturbance.

If blood be drawn during the progress of the disease, it will generally be found to exhibit a sizy appearance. Sometimes it is deeply buffed and even cupped. What internal, or intrinsic changes, the mass of blood undergoes in this affection has not been satisfactorily determined.

Diagnosis.—Erysipelas is generally so well marked as to render it impossible to confound it with any other disease. The only form which is liable to cause error of diagnosis is the simple, which may be mistaken for erythema, which it certainly very much resembles. The signs of discrimination are, the peculiar character of the pain, which is sharp, pungent, and smarting in erysipelas, and almost absent in erythema; the deeper redness in the former than in the latter, and the tendency also to the evolution of vesicles, which does not exist in erythema.

Pathology.—The pathology of erysipelas has been a fruitful subject of discussion almost from time immemorial, and yet, notwithstanding all that has been said and written about it, it is still involved in impenetrable obscurity. How it is induced, what is its seat, or where it originates, are points concerning which we are wholly ignorant. We only know that it has a peculiar predilection for the dermoid and cellular tissues, and that it is usually, if not invariably, connected with disorder of the general system, affecting, probably, both solids and fluids. So thoroughly am I convinced of the latter fact, that I do not believe it would be possible for erysipelas ever to appear in a perfectly sound individual. If this be true, as I think multiplied and carefully conducted observation authorizes me to affirm, then derangement of the general health, especially as displayed in a vitiated condition of the digestive organs, must be regarded as a most important element in the pathology of this affection, and one which must exert a marked influence upon our curative agents. The opportunities constantly afforded the surgeon, in cases of accidents and operations, of testing this point, peculiarly qualify him for pronouncing upon the question. I am not now, of course, speaking of epidemic erysipelas, to which every one is more or less liable, but of the ordinary form, the

development of which, as is well known, is so much influenced by intrinsic and extraneous circumstances, as the health and habits of the patient, his residence, the nature of his diet, and the state of his mind. When a person is intemperate, breathes a foul air, eats bad food, or has a troubled mind, the most trivial injury, as the merest prick of the finger, is often followed by a fatal attack of the disease, whereas another, although severely hurt but enjoying better health will, perhaps, escape entirely, or suffer only in a slight degree. The surgeon, aware of this circumstance, constantly acts upon it in practice, making it a rule never to perform any serious operation until he has put his patient in a proper condition for it by the rectification of his secretions and the improvement of his general health.

Erysipelas has sometimes been regarded as consisting essentially in a bad form of capillary phlebitis, it being alleged that the smaller veins are generally found to be involved in the disease, as is shown by the inflamed condition of their coats, and the existence, in their interior, of various kinds of substances, as lymph, pus, and coagulated blood. Such changes undoubtedly occur, to a greater or less extent, in all severe cases of the malady; but they occur, not as a cause, but as a consequence of the morbid action. Other pathologists, again, consider erysipelas as being essentially an affection of the lymphatics; and, lastly, there is another class who look upon it as originating in both these vessels. All these views, however, amount to nothing but conjecture, their truth or falsity remaining to be established.

Prognosis.—The prognosis in erysipelas is influenced by the character, extent, and seat of the morbid action, by the age and habits of the patient, and by the absence or presence of complications. Phlegmonous erysipelas, other things being equal, is generally more dangerous than the simple or œdematous, as it is more liable to end in extensive suppuration, gangrene, and metastatic abscesses. A simple erysipelas, however, if of great extent, is hardly less dangerous to life than a phlegmonous one, the shock to the nervous system being nearly as severe as in a superficial but extensive burn, which often kills on this account. When the disease attacks the head it is always more to be dreaded than when it makes its appearance upon other parts of the surface. Infants, young children, and old persons bear the disease badly; as do also the habitually intemperate. Erysipelas is particularly dangerous when it occurs during the progress of other maladies, as measles, scarlatina, and typhoid fever. Epidemic erysipelas is always a more destructive disease than a sporadic one, the malady, under such circumstances, impressing itself with peculiar force upon the constitution. Traumatic erysipelas often kills in a surprisingly short time. In the summer of 1856, I attended a young butcher, who died in less than three days from a violent attack of this disease of the hand and arm, brought on by a punctured wound inflicted by a hook used for hanging meat upon in the market house.

TREATMENT.

Erysipelas being capable of being developed by such a variety of circumstances necessarily demands a corresponding variety of treatment. Experience long ago showed that remedies which afford relief in one case are productive of no benefit in another, and hence it is all important, in every instance, that our curative measures should be based, if possible, upon a correct appreciation of the nature of the exciting causes. If the practitioner should attempt to combat it upon any other principle, he will find himself sadly mistaken.

The treatment of this disease may conveniently be divided into constitutional and local, and it is hardly necessary to add that each head embraces a great variety of means, which it will be necessary to pass briefly in review. The constitutional remedies upon which our reliance is mainly to be placed are, bloodletting, emetics, purgatives, diaphoretics, mercurials, and anodynes.

Bloodletting is not applicable in all cases of erysipelas; on the contrary, there are some in which it inevitably proves mischievous, if not fatal, by augmenting the debility of the system, already, perhaps, greatly depressed by the violence of the morbid action. The circumstances which, in my judgment, render a resort to the lancet proper in this complaint are, first, a strong, full, and frequent pulse; secondly, a robust and vigorous state of the system; thirdly, excessive pain and tension of the parts; and, lastly, the involvement, threatened or actual, of important internal organs, as the brain, lungs, and throat. The amount of blood to be abstracted must depend upon the effects which the operation exerts upon the system. One moderately copious bleeding, performed early in the disease, will usually be sufficient, and will answer a much better purpose than two or three small ones. It should be borne in mind that venesection should never be carried as far in epidemic as in sporadic erysipelas, and in old, sickly, or intemperate persons, as in the young, robust, and plethoric. In the epidemic erysipelas which prevailed so extensively a few years ago in various sections of the United States, the abstraction of blood was generally borne very badly, and many lives were lost by its injudicious employment. In the Louisville Hospital not a single patient recovered that was bled for this disease. In erysipelas supervening upon capital operations and severe accidents, as compound fractures and dislocations, wounds, and contusions, proper allowance must be made by the practitioner for the effects of shock and loss of blood, and the resulting suppurative discharges. Children affected with erysipelas rarely, if ever, require bleeding in any form.

Great contrariety of opinion has prevailed among writers respecting the employment of *emetics* in this disorder, some having pointedly condemned them, while others have expressed themselves most warmly in their favor. In the hands of Desault and his disciples the greatest benefit seems to have attended their exhibition. The probability is that here, as elsewhere, in similar cases, the truth lies between the two extremes; for it can hardly be supposed that a class of remedies of such acknowledged potency in many cutaneous affections should be

altogether useless in erysipelas. The cases in which, according to my observation, emetics are mainly indicated are those in which there is marked biliary derangement, along with nausea, loathing of food, headache, pain in the back and limbs, great restlessness, and dryness of the surface. These symptoms, so distressing to the poor sufferer, are often promptly relieved by full emesis, excited by ipecacuanha and tartrate of antimony, ipecacuanha alone, or salt and mustard, and encouraged by the free use of tepid drinks. In protracted cases, and in the erratic form of the malady, attended with derangement of the digestive organs, gentle emetics often operate like a charm in breaking up the chain of morbid action.

When it is remembered that this disease is often directly dependent upon an overloaded state of the bowels, the presence of irritating ingesta, and the suppression of the secretions of the digestive organs, it is not difficult to discover a reason for the high estimate which has always been placed upon the administration of *purgatives*. Indeed, it would be hard to find a case in which it would be altogether improper to dispense with it. In my own practice I have always derived from it the most signal benefit, especially in the earlier stages of the complaint, although there is no period in which it can perhaps be entirely omitted with safety. The articles upon which I mainly rely are calomel, rhubarb, and compound extract of colocynth, variously combined, and given in sufficient quantity to produce two or three free and consistent motions. Sometimes the addition of a little antimony or ipecacuanha proves beneficial, especially when there is an arid state of the skin and mouth; while occasionally they may be advantageously replaced by others, as castor oil and spirits of turpentine, oil alone, senna, or Epsom salts. When there are nausea and headache, with a highly coated tongue, the best cathartic, in general, is calomel and ipecacuanha, in the proportion of about fifteen grains of the former to two grains of the latter, followed, if necessary, in six or eight hours, by a stimulating enema, or some of the magnesian sulphates. When the bowels have been once thoroughly evacuated, a moderate passage should daily be induced by some mild laxative, as blue mass and rhubarb, Seidlitz powder, or colocynth and hyoscyamus.

Diaphoretics constitute a valuable class of remedial agents in the treatment of this affection, and can seldom be entirely dispensed with, as there are few cases in which the cutaneous function is not more or less interrupted, perverted, or suspended. After proper depletion by the lancet and purgatives, or, at all events, thorough evacuation of the bowels, and the restoration of the secretions of the digestive organs, the administration of medicines calculated to act upon the skin often proves eminently serviceable. Among the best of this group of articles are Dover's powder and the salts of antimony and morphia, aided by tepid sponging, or, when the patient's strength admits of it, the warm bath. In children and debilitated persons, the spirit of Mindererus and wine of ipecacuanha may be advantageously resorted to. Aconite, in doses of three drops, every two, three, or four hours, generally answers an excellent purpose, especially when there is a hot and arid

condition of the surface, and inordinate excitement of the heart. The same is true of veratrum.

There are few cases of erysipelas, even of the milder grades, in which the use of *anodynes* is not indicated, either for the purpose of allaying pain, or of inducing sleep. When the malady occupies, as it not unfrequently does, an unusual extent of surface, the system is very apt to suffer in the same manner as in severe burns and scalds, and requires, at a very early stage of the complaint, the employment of soothing measures. The remedy, which is commonly one of the salts of morphia, is administered upon the same principles as in other inflammatory affections, either by itself, or in union with other articles, especially diaphoretics, in quantities proportioned to the exigencies of each particular case. As a general rule, the object is best attained by a full dose, repeated once or twice in the twenty-four hours. To an adult, laboring under great pain and restlessness, provided there is no cephalic trouble, not less than half a grain of morphia should be given at a time. Thus administered, the effects of the remedy are much more decided and beneficial than when it is exhibited in smaller doses, as is too often the case with practitioners, not only in this, but in other inflammatory maladies. Delirium, or cerebral disorder, does not necessarily contra-indicate the use of anodynes; on the contrary, persons so affected are often immensely benefited in a short time by their judicious exhibition. To no class of patients is this remark more applicable than to habitual inebriates, and individuals worn out by previous disease, loss of blood, protracted drainage of the system, or constitutional irritation. Such persons absolutely require, at an early period, and in every stage of the malady, the use of anodynes in large doses, in order to prevent exhaustion, and afford time and opportunity for the more efficient action of other remedies.

Mercurials are sometimes usefully exhibited in this disease. They are particularly valuable in the erratic form of erysipelas, and when there is a tendency in the malady to linger in the system, after its principal force has been exploded, but when it is still disposed, as it were, to dispute with the practitioner every inch of its possessions. In such cases, they occasionally act like a charm, even when they are not carried to the extent of ptyalism, which, however, is often necessary, before the disorder will relinquish its grasp. During the epidemic erysipelas which prevailed in Louisville and its vicinity in 1844, '5, and '6, I treated quite a number of cases upon this plan, with the most happy results, although now and then a patient was lost, even after the establishment of slight salivation. Mercurials should be most scrupulously avoided in erysipelas attended with a low, typhoid state of the system in old, worn-out subjects, and in persons exhausted by intemperance and dissipation. The best form of exhibition, when the remedy is indicated, is calomel with a small quantity of opium and ipecacuanha, or Dover's powder, to restrain its action on the bowels and allay nervous irritation. In urgent cases two grains of the metal may be given to an adult every four or six hours, combined with half a grain of the anodyne. When a less rapid impression is desired, blue mass, iodide of mercury, or the gray powder may be used. In

whatever form or manner the remedy be given, its effects should be most carefully watched, and they should never be carried beyond the limits of the slightest possible ptyalism.

The late Professor John K. Mitchell informed me that he had, for years past, derived more benefit, in this disease, from the use of *iodide of potassium* than from any other remedy. His plan was, after gentle alvine evacuation, to begin at once with the article, giving it, largely diluted with water, every two or three hours, in doses from five to ten grains, until the attack was arrested, which, it would seem, usually happened in a few days. In the few trials which I have made of this remedy, I have witnessed no material benefit, and in several cases I was obliged to suspend it at an early period, on account of its disagreeing with the stomach.

Stimulants and tonics are required when there is, as occasionally happens even in the early stage of the disease, a tendency to excessive prostration. A hard, dry, and brownish tongue, sordes on the teeth, a small, feeble, and frequent pulse, twitching of the muscles, coolness of the surface, and copious sweats, with or without delirium, clearly indicate the necessity of the employment of this class of remedies, which are sometimes alone capable of arresting the disease and of establishing convalescence. The articles ordinarily resorted to for this purpose are ammonia, wine, brandy, porter, or ale, along with quinine, or some of the mineral acids, and nourishing broths. Of all these substances, the best by far is brandy, in the form of milk punch, julep, or toddy. Quinine may also generally be used with great benefit, and there is no internal remedy which I so frequently employ in the latter stages of erysipelas, or in cases demanding a decided tonic. The proper dose is from three to five grains every four, six, or eight hours.

Lately, the tincture of the *chloride of iron* has been much employed by practitioners of this city, and apparently with very gratifying results, in doses varying from fifteen to thirty drops, from three to six times in the twenty-four hours. It is particularly serviceable where a tonic effect is indicated, and is, therefore, best adapted to feeble, delicate subjects, laboring under a deficiency of hematosin, or the coloring matter of the blood. Like iodide of potassium, however, and some other articles, it is apt to disagree with the stomach, and should, therefore, be given with some degree of caution, the best plan being to suspend it in some pretty thick demulcent fluid.

Throughout the whole treatment, the greatest attention should be paid to the ventilation and temperature of the patient's apartment; the body and bedclothes should be daily changed; and the cutaneous surface should be frequently sponged with tepid salt water, or some slightly alkaline solution. As disinfectants, free use is made of the chlorides. As soon as his strength admits of it, the patient should take gentle exercise in the open air, and, if possible, sleep in another apartment.

All *topical* remedies in the treatment of this disease are to be regarded rather as auxiliary than as curative agents. Looking upon the cutaneous eruption merely as a local manifestation of a constitutional disorder, the philosophical practitioner will place his reliance

mainly upon internal means, and consider all external ones as of secondary moment. Nevertheless, it would be wrong, even in many of the milder cases, wholly to neglect these, since experience has abundantly attested their utility. A vast variety of applications, many of them of the most opposite character, have been recommended with this object, as warm and cold, dry and moist, astringent and relaxing, stimulating, vesicant, and anodyne. It would seem, indeed, as if almost every article of the materia medica had been called into requisition, as if to show what little confidence, as a general rule, is to be placed in their efficacy.

At the head of the list of local remedies may be placed *leeching*, concerning the efficacy of which, however, practitioners are still divided in opinion. My own belief is that it may often be employed with great advantage, though, in general, it is, I think, entirely unnecessary. The fact that the operation is occasionally followed by erysipelas does not, in my judgment, prove that it may not at times be beneficial. It is only in rare cases, and under peculiar circumstances, as when the patient is of a very irritable habit, or the leeches are sickly, that such a result is at all likely to occur. Against such a contingency the judicious practitioner will, of course, always guard. The use of the remedy is particularly indicated in erysipelas of the throat and larynx, the scalp, eyelids, vulva, toes, and fingers. The number of leeches must vary according to circumstances, as the intensity of the morbid action and the vigor of the patient; and the flow of blood should always be encouraged by warm fomentations until the desired quantity is obtained.

One of the great topical remedies at the present day for the cure of erysipelas is *iodine*, either in the form of tincture, or solution. I generally give the preference to the former, diluted with an equal quantity of alcohol, and laid on by means of a large camel hair pencil, the end of a stiff feather, or a soft cloth mop, until the surface is of a yellowish, brownish, or mahogany color. The application should embrace a small portion of the sound skin, and should be repeated at least twice, if not thrice, in the twenty-four hours. In the milder grades of erysipelas a single application will occasionally suffice for a cure; while in the more aggravated a considerable number may be required before the disease is finally discussed. The remedy is sometimes productive of severe pain, especially in nervous, irritable, and thin-skinned persons, which may persist for several hours, and which hardly anything, save time, will allay. To obviate this occurrence, the first application should always be very light; if no inconvenience arise, the medicine may afterwards be used more freely, and may even, in some instances, be advantageously carried to the extent of vesication. If, notwithstanding this precaution, the pain be very severe, the part should be freely sponged with a weak solution of iodide of potassium, and covered with a starch poultice.

I have employed the tincture of iodine in the form and manner here indicated for many years, both in the sporadic and the epidemic varieties of the disorder, and can confidently assert that I have derived more benefit from it than from any other article of which I have

any knowledge. Resorted to in the early stage of the disease, it rarely fails promptly to relieve the pain and tension, which form such prominent features in the symptomatology of the affection, and which add so greatly to the patient's suffering. The beneficial effects of the remedy appear to be due to its stimulant and sorbefacient properties, which rapidly promote the removal of effused fluids, and assist in checking morbid action. When applied very freely it occasionally vesicates, and is thus instrumental in unloading the cutaneous capillaries. Doubtless, it also acts advantageously upon the blood and its vessels, indisposing them to further effusion.

Another highly valuable agent for the cure of this disease is the nitrate of *silver*, employed either in substance, or in strong solution. It is applied either directly to the affected surface, or a belt is drawn around it upon the healthy skin, to prevent its further spread, which constitutes such a distinguishing trait in its symptomatology. I commonly prefer the former method, using the solid nitrate instead of the solution, so strongly recommended by Mr. Higginbotham. In order to apply this substance properly, it is necessary, as a preliminary step, that the surface should be divested of all greasy and perspirable matter, otherwise it will refuse to unite with the epidermis, and so prove, in great measure, inert. The part should then be gently moistened with cistern water, when the caustic is passed firmly and efficiently over it until the whole has been thoroughly touched. Thus employed, the application speedily blackens the epidermis and coagulates its albuminous matter, thereby forming an excellent defence to the delicate tissues beneath. When used more freely it generally vesicates, elevating the scarf-skin into tolerably large blisters. Mr. Higginbotham applies a strong solution of the nitrate of silver, consisting of eight drachms of the salt to the ounce of water, with the addition of a small quantity of nitric acid. I have no experience with the remedy in this form. The probability is that nitrate of silver produces its beneficial effects very much in the same manner as the tincture of iodine, changing the tone of the capillary vessels and promoting the absorption of effused fluids, besides serving as a direct defence to the cutaneous surface by its union with the albuminous matter of the superficial layer of the skin.

Professor Gilbert, of this city, has been in the habit of using, for a long time past, pure *creasote* as a remedy in erysipelas. He applies it lightly, once a day, to the affected surface with a camel-hair pencil, and has found it more effectual in arresting the disease than any other article he has ever tried. It destroys the cuticle, converting it into a whitish substance, which thus defends the inflamed surface from the contact of the air.

Solutions of acetate of *lead* and opium, Goulard's extract, alcohol, chloride of sodium, carbonate of potassa, sulphate of copper, quinine, and bichloride of mercury often prove beneficial in this disease. They are employed of varying strength, and are generally most grateful when used tepid, upon flannel cloths, frequently renewed. In warm weather, and in strong, plethoric subjects, they may be applied cold, but when

this is done their effects should be sedulously watched, lest they repel the disease, or force it upon some internal organ.

Dr. Pitcher, of Detroit, some years ago, published a short article upon this disease, in which he strongly recommended, as an external application, the bichloride of *mercury*, in the proportion of twenty grains of the salt to the ounce of alcohol. During the prevalence of the epidemic to which I have already so frequently alluded, I had occasion to try this treatment in quite a number of instances, and came to the conclusion that it possessed no advantage whatever over iodine and nitrate of silver. In nearly all the cases, upwards of twenty, the application was promptly followed by vesication and excessive pain, and, in a few, by pretty profuse ptyalism; effects which greatly aggravated the local and constitutional suffering, and rendered a speedy discontinuance of the remedy necessary. I have since tried the medicine in weaker solution, but without any encouraging results.

Mons. Velpeau appears to have great confidence in the use of sulphate of *iron* as a local remedy in erysipelas. The praises, however, which he has lavished upon it have not been realized by practitioners generally, and the probability, therefore, is that they are undeserved. In the trials which I have made with it, but which have not been numerous, I have been sadly disappointed. It may be employed in solution, in the proportion of half an ounce to two thirds of a quart of water; or as an ointment, prepared by mixing one drachm of the impalpable powder with an ounce of lard. The former is applied by means of compresses, frequently moistened; while the latter is rubbed on freely several times in the twenty-four hours.

In the milder varieties of erysipelas I have occasionally witnessed most excellent results from a *liniment* of equal parts of laudanum, ammonia, and olive oil, applied with a soft, thin compress. When the skin is very delicate, the proportion of ammonia may be diminished. The common soap liniment, with the addition of a small quantity of tincture of iodine, is also a valuable remedy in simple erysipelas.

Various *greasy substances*, cerates, and unguents have been recommended by practitioners, and employed by the vulgar, in the treatment of this affection; but there are few surgeons who place much reliance in any of them. Perhaps the best is the mercurial ointment, first advised in this complaint by Dean and Little, of Pennsylvania. A thick layer of this is spread upon cloth, and secured to the part by means of a bandage; or, what is preferable, rubbed gently but efficiently upon the surface. The article has been highly lauded by Rayer and others, but my own experience has not supplied me with any facts in its favor. The opinion at the present time appears to be that the mercurial ointment of the shops does not possess any particular advantage over common lard, or simple cerate, and, from all that I can learn, the remedy would seem to have become nearly obsolete. I should certainly place no special confidence in it in the more severe forms of the malady, while in the more simple I should not deem it necessary to resort to it. In infantile erysipelas, I have sometimes derived good effects from the application of calamine cerate, diluted with two parts of lard. Professor Gibson has sometimes used, with marked benefit,

the preparation known under the name of British oil; and Dr. Coates, of this city, has successfully employed tar ointment.

Dusting the affected surface with starch, flour, arrowroot, prepared chalk, carbonate of zinc, pearl powder, and similar substances, is a popular remedy, which is sometimes useful in the more simple varieties of erysipelas, but entirely unavailing when the disease is deep-seated, or of a phlegmonous character. In the former, they sometimes prove beneficial by relieving the disagreeable itching, smarting, or burning sensation of the skin. In superficial erysipelas, I have occasionally obtained advantage from painting the inflamed surface with collodion; the application appears to impart a healthful stimulus to the cutaneous capillaries, to incite the absorbents, and to contract the skin and subjacent cellular tissue.

The treatment of erysipelas by *blisters*, formerly so much in vogue in this country, has of late fallen into undeserved neglect. In my own practice I have frequently resorted to it, and in hardly any case has it disappointed my expectations. The remedy is peculiarly valuable in the phlegmonous form of sporadic erysipelas, and in erysipelas supervening upon wounds, ulcers, chancres, buboes, and abrasions. My practice is to apply the blister directly to the inflamed surface, with a small margin for the sound skin, and to retain it until it has produced thorough vesication. The serum is then discharged with a needle, and the part dressed with a light starch, elm, or some other emollient poultice. In children, and old or sickly persons, the blister must be removed at an earlier period, otherwise serious mischief may ensue from its overaction.

Much has been said, of late years, respecting the importance of *punctures* and *incisions* as means of relief in this complaint. Of the propriety of this mode of treatment, no one acquainted with its character can entertain the slightest doubt in any case, accompanied by suppuration, great tension, and impending gangrene. Under such circumstances, indeed, all other means must be regarded as of secondary moment; the knife alone is to be trusted, and the sooner it is resorted to the better. A few incisions, or a number of large punctures, will obviate an immense amount of mischief, by affording vent to effused fluids, as serum, lymph, pus, and even blood, relieving capillary strangulation, and removing pain and tension. The period for putting this practice in force is the moment there is the slightest perceptible fluctuation, and, in violent cases, even as soon as pain and throbbing show themselves. By thus anticipating the suppurative process, the patient escapes much suffering, as well as loss of texture; for, if the matter be retained in the parts, its inevitable tendency is to burrow among the surrounding structures, and, by being absorbed into the system, to contaminate the constitution. From neglect of this practice, many patients perish that might otherwise be saved, and many limbs are lost, or rendered useless for life.

In practising incisions for the relief of erysipelas, it is not necessary that they should be made three, four, or five inches in length, as recommended by Mr. Lawrence and other British surgeons. Such a procedure is eminently cruel and reprehensible, and it is difficult to conceive

how it should ever have received the sanction of enlightened practitioners. Independently of the pain which attends it, it is liable to be followed by copious hemorrhage, which, occurring at a time when the patient is perhaps ill able to bear it, is well calculated, in many cases, to hurry him on to a fatal issue. I must, therefore, enter my solemn protest against such a barbarous practice. Incisions, I repeat it, are often eminently serviceable, if, indeed, not indispensable both to the part and system; but let them be made in a proper manner, and of proper dimensions. A cut from half an inch to an inch and a half in length, and deep enough to liberate the pent-up fluids, ought to be sufficient in any case, unless there has been great mismanagement on the part of the patient, or his professional attendant. In such an event, the incisions may be multiple, being placed at suitable intervals from each other. It is hardly necessary to add that, in performing the operation, the knife should not be carried in the direction of any important structures, as large vessels, nerves, or joints. If hemorrhage be unavoidable, it is to be arrested by the usual means, as compression, styptics, or ligation. The best application after the bleeding has ceased is an emollient poultice, or the warm water-dressing, either simple or medicated. The loss of a small quantity of blood is often of essential benefit in relieving the disease.

Punctures are more particularly useful in the œdematous forms of the disease, to evacuate the serous fluid upon which the distension depends, and which often forms a source of so much mischief. When suppuration or gangrene is threatening, punctures, as already stated, give way to incisions. The number of punctures, the depth to which they should be carried, and their proximity to each other, must depend upon circumstances. The best instrument for making them is a very narrow, sharp-pointed bistoury, introduced perpendicularly to the surface, with the necessary care to avoid important structures.

Finally, valuable aid may be derived, in almost every case of erysipelas of the extremities, from the application of the *bandage*. It is particularly efficacious in the early stages of the disease, being well calculated, if judiciously employed, to afford support to the affected structures, and to prevent vesication and suppuration. The application should be made as equably as possible, and with a certain degree of firmness, its effects being carefully watched, and aided by simple or medicated lotions.

SECT. II.—FURUNCLE, OR BOIL.

A furuncle, vulgarly called a boil, is a peculiar inflammation of the skin and cellular substance. Liable to occur upon any portion of the body, excepting, perhaps, the palm of the hand and sole of the foot, it is most common upon the face, nape of the neck, buttocks, and fingers, often forming in considerable numbers, either simultaneously or successively, although generally there is only one. Both sexes, and all periods of life are subject to it; the young, however, suffer more frequently than the old and middle-aged. Some persons are habitually

affected with boils, being seldom entirely free from them at any time for years. Now and then they disappear for a while, and then suddenly break out again. Attacks of boils are a very common sequel of eruptive affections, as smallpox, measles, scarlatina, and typhoid fever. Children during dentition, and during chronic attacks of cholera, occasionally suffer enormously from this cause. I have often, in these complaints, seen the whole surface literally covered with boils, the patient experiencing great torment and bodily weakness.

The causes of furuncle are generally inappreciable. Occasionally we can trace their formation to external violence, as a contusion, or the concussion sustained by the skin and cellular substance in riding on horseback. In the majority of cases, if not in all, it is obviously connected with a disordered state of the digestive organs, or with some derangement of the secretions. Thus, persons who labor habitually under disease of the liver, and females who are troubled with irregularity or suppression of the menses, are very prone to suffer from its attacks.

A boil consists essentially in a circumscribed inflammation of the skin and subcutaneous cellular tissue, eventuating in suppuration and sloughing. It usually begins as a small, hard, red pimple, which, as it proceeds, gradually assumes a conical figure, the apex being formed by the skin, and the base by the cellular substance, its volume varying from that of a currant to that of a pigeon's egg. The pain which accompanies it is, at first, of a burning, smarting character, but afterwards, especially when matter is about to be deposited, it becomes throbbing and exceedingly severe. A sense of tension is also commonly present. The skin is of a dusky, reddish aspect, and exquisitely sensitive to the slightest touch. As the tumor increases, a little vesicle forms at its apex, containing a drop of serum, and indicating the point where the boil will discharge itself. If the furuncle be large, or multiple, there will usually be more or less constitutional disturbance, as manifested by the want of appetite, a bad taste in the mouth, headache, chilliness, and a feeling of general uneasiness. Finally, if the disease occur in the lower extremity or upon the buttock, there will often be sympathetic enlargement of the glands of the groin, and in the upper extremity of the glands of the axilla. The period required for a boil to reach its height varies from three to eight days.

If a section be made of a boil, with a view to the examination of its structure, it will be observed to consist of a mass of dead cellular substance, ordinarily called a core, immersed in thick yellowish pus, the parts around being very hard, matted together with lymph, and preternaturally vascular. The skin is also indurated, and abnormally tense, red, and injected. Occasionally the contents of the swelling are almost wholly made up of blood, or of a mixture of blood, pus, and slough. This form of boil, to which the term hematoid may be applied, is most common in elderly persons of a broken constitution, and is generally attended with a great deal of local and general distress.

It is seldom, under any circumstances, that a furuncle can be made to abort, or to terminate in resolution, its invariable tendency being

to suppurate and slough. In its very incipiency, I have occasionally, though very rarely, succeeded in arresting its course by a brisk purge, and the application of iodine, but if it have already made some progress, such an attempt will prove altogether futile. The best plan generally is at once to poultice the part, and make an early and free incision to let out its contents. The relief experienced from the operation is always prompt and decided. If the sore is slow in healing, either from the retention of dead cellular tissue, or want of healthy action from other causes, its surface should be well touched with nitrate of silver; the same article, iodine, or a small blister being applied to the surrounding surface. In most cases the patient will be benefited by purgative medicine and light diet.

When there is a decided furuncular diathesis, as when a great number of boils exist simultaneously, or form in pretty rapid succession, benefit may be expected from an emetic, and from mercurial purgatives, with the internal use of iodide of potassium and Donovan's solution. Sometimes Fowler's solution of arsenic answers a good purpose, or, what I prefer, arsenic in substance, from the twentieth to the thirtieth of a grain three times a day. In very obstinate cases slight ptyalism may be required before the disease finally yields. When boils are developed as a consequence of exhausting diseases, tonics, mineral acids, a nutritious diet, and country air are indicated. Alkalies should be used when there is evidence of acidity of the stomach and bowels. Daily bathing with salt water, or water impregnated with potassa, will occasionally be serviceable, especially when there is unusual torpor of the skin.

SECT. III.—ANTHRAX, OR CARBUNCLE.

The most accurate definition that can be given of a carbuncle is that it is a boil on a large scale, it being, like that affection, a peculiar inflammation of the cutaneous and cellular tissues, but, instead of being circumscribed, as in that disorder, it manifests a disposition to spread. Its most common seat is the posterior part of the trunk, particularly the nape of the neck, near its junction with the occiput. The gluteal and sacral regions are also liable to the disease, but it is very seldom that it occurs in the extremities. I have several times seen a bad form of carbuncle upon the chin and lower lip.

Carbuncle is most common in old persons. I have never met with it in infancy and childhood, and, therefore, take it for granted that it is very infrequent at those periods of life. It is also very rare in young adults. Both sexes are liable to its attacks, but in what proportion has not been ascertained. The greatest number of cases that have fallen under my observation occurred in men. It is a matter of general observation that fat, elderly persons, who are huge feeders, and take but little exercise, are more liable to suffer from the disease than any other class. In the female, it is often dependent upon suppression of the menstrual function. I am not aware that habitual dram drinkers are particularly prone to carbuncle; certainly not as

much as large eaters. It is said, however, that the lower orders of London, who make constant use of porter, are singularly subject to it. Season may possibly exert some influence upon the production of the disease, but in what manner or degree, is undetermined. It is generally thought, however, that it is more frequent in winter and spring than at any other time. Carbuncle is one of the symptoms of plague. The extent of the inflammation varies from that of a dollar up to that of a large saucer, its average being about that of the palm of a small adult hand.

Of the exciting *causes* of carbuncle nothing whatever is known. Most commonly the outbreak of the disease is ascribed to the effects of cold, to disorder of the stomach, over-eating, constipation of the bowels, loss of sleep, excessive venery, and other debilitating causes; but how far, or in what degree, these circumstances tend to influence its development it would be extremely difficult to assert. I have myself long regarded the malady as essentially of a constitutional nature, resembling, in this respect, erysipelas and some other affections; and the history of the disease would certainly seem to warrant such an inference. A long course of debauch, or indulgence in the pleasures of the table, attended with a vitiated state of the secretions, is, as is well known, eminently conducive to the development of carbuncle in its worst forms. When persons have been for years in this condition, eating and drinking luxuriously, and taking hardly any exercise, the slightest exposure to cold, suddenly checking the cutaneous perspiration, would, it may easily be imagined, tend to develop the disease in a part habitually congested and enfeebled in its action. But there is, under such circumstances, not merely a bad state of the solids; the blood also comes in for a share in the proceeding, surcharged, as it must be, with irritating materials which the solids have long been unable to throw off in the form of recrementitious substance. Whether, however, this conjecture be correct or not, the fact is indisputable that carbuncle is rarely, if ever, of traumatic origin; or found in persons of a vigorous and healthy circulation.

The first *symptom* of carbuncle is generally an itching, burning, or smarting, with a sense of numbness, in a particular part of the skin, which, on examination, is found to be of a dusky, reddish color, slightly tumid, and somewhat tender on pressure. As the disease progresses, the local distress sensibly increases; the pain soon becomes throbbing and exceedingly violent, the part feeling as if it were in contact with molten lead; the surface assumes a livid hue; the swelling spreads both in circumference and in depth; and the slightest touch of the finger is intolerable. Along with these phenomena, the patient usually experiences a sense of weight and tension, which greatly add to his suffering. The part is hard, and circumscribed, feeling like the rind of bacon, and occupying a space from the size of a dollar to that of the palm of the hand. Presently vesicles begin to form at the focus of the inflammation, containing a dirty turbid, yellowish, or sanguinolent fluid, and generally not exceeding the diameter of a pea, though occasionally they are quite large. Upon bursting, these vesicles expose a corresponding number of openings in the true skin, giving the

surface a cribriform appearance, and leading down into the cellular substance, which is already in a state of mortification. The ulcers, for so they may be called, have an irregular, ragged appearance, and are the seat of a foul, irritating discharge, which is often very abundant and exhausting.

Upon dividing the affected structures, the skin is found to be remarkably dense and firm, cutting very much like the rind of bacon. The cellular substance beneath is converted into a slough, having the appearance of a mass of wet tow, being bathed with ill-looking matter, and intermixed with flakes of lymph, or matter like putty, thick pus, or curds. When the disease is of unusual extent, there may be considerable involvement of the aponeuroses and muscles, but in general these structures are excluded from the morbid action, the skin and subjacent cellular tissue alone suffering. At the periphery of the disease the parts are always uncommonly dense, the boundary between it and the healthy structures being established by a deposit of plastic matter, less organizable, however, than in furuncle, the morbid anatomy of which that of a carbuncle so closely resembles. The sub-

Fig. 147.



Carbuncle in its forming stage.

Fig. 148.



Ulcerated carbuncle.

joined sketches (figs. 147 and 148) represent this disease in its earlier and more advanced stages.

The *constitution* always, at an early period of the disease, strongly sympathizes with the part affected. Hence, fever is generally present soon after its commencement, and sometimes, indeed, almost before there is any marked evidence of the local affection, the first symptom being often a severe rigor, followed by high vascular excitement. However this may be, the case soon assumes an asthenic type, indicative of the depraved condition of the solids and fluids which we have supposed to be so intimately concerned in the production of the disease. The tongue speedily becomes dry, hard, and brown, sordes

collect upon the gums and teeth, the appetite fails, gastric derangement exists, the bowels are constipated, the urine is scanty and high-colored, the skin is hot and arid, the mind is disposed to wander, and the pulse is frequent, soft, and without force. Vomiting is often present to a considerable extent, and the alvine evacuations are generally excessively fetid.

I know of no disease with which carbuncle can be *confounded.* Its large size, the severity of the attendant pain, and the great constitutional disturbance will always readily distinguish it from furuncle at its commencement, and afterwards the diagnosis will be still further aided by the vesicated and cribriform condition of the skin, so characteristic of carbuncle. The only affection which it at all resembles is a bedsore, but the history of the case, and the situation of the swelling, will always serve as means of discrimination. Malignant pustule begins as a little circumscribed pimple, not as a diffused swelling, as in anthrax, and soon forms a large vesicle, raised above the surrounding level, and resting upon a hard, solid base, which rarely acquires much extent, at least not until the affection has made considerable progress.

A carbuncle ought generally to be viewed as a *dangerous* disease, especially so when it occurs in old and fat subjects, who have long been addicted to indolence and over-feeding. The site of the disease will also exert a marked influence upon the issue of the case. Thus, a carbuncle situated on the back part of the head and neck will, other things being equal, be more likely to produce death than when it occupies the back, nates, or extremity, for the reason that it is extremely apt to involve the brain and arachnoid membrane, causing effusion of serum and lymph. Young and comparatively healthy persons will often recover, though generally not without great suffering, whatever may be the site of the malady.

Treatment.—The treatment of carbuncle must be conducted with special reference to the improvement of the secretions and the support of the system. Few patients will be found to bear bleeding, or anything like active purgation. It is only when there is extraordinary plethora, combined with great vigor of constitution, that these means should be carried into effect. In all other cases, their inevitable tendency will be to do harm, by bringing on premature exhaustion. Efficient purging, however, may be regarded as an indispensable remedy in almost every instance, the object being not only to get rid of irritating fecal matter, but to produce a change in the secretions. For this purpose the medicine should be given early in the disease, and a mercurial cathartic should always be preferred to any other. When marked gastric derangement exists, as indicated by nausea, headache, and pain in the limbs, no time should be lost in administering an efficient emetic, or an emeto-cathartic, as ten grains of calomel and from ten to twenty of ipecacuanha, followed by large draughts of chamomile tea, or infusion of valerian. Clearance having been effected, and function improved, or restored, stimulants and tonics will come into play, exhibited warily, especially if cerebral trouble is threatened, yet efficiently if evidence of exhaustion is present, the

most suitable articles being ammonia, quinine, and brandy, with nourishing broths. Anodynes will generally be required, in large doses, to allay pain and procure sleep. After the first few days a mild laxative, as blue mass or castor oil, is occasionally given. Determination to the brain must be promptly met by a large blister applied as near as possible to the occiput.

The best *topical application*, in the early stage of carbuncle, is the warm water-dressing, medicated with acetate of lead and opium. Pencilling the surface well with tincture of iodine, and then covering it with a mixture of equal parts of olive oil, laudanum, and spirits of turpentine, sometimes produces a very soothing effect. In many cases, there is nothing so promptly beneficial as a blister, large enough to include a considerable portion of the healthy skin, and retained until it has caused thorough vesication; it drains the vessels of serum, allays pain, and makes a salutary impression upon the general system. Leeches are commonly inadmissible, as they cause severe pain, and undue depletion. But the great remedy for carbuncle, as for furuncle, is free incision, the knife being carried down deep into the cellular substance, not at one point, but at a number. The operation, which should be practised as soon as possible at the focus of the disease, and afterwards towards the periphery, should there be any necessity for it, at once relieves the horrible pain and tension of the part, affords nature an opportunity of casting off the sloughs, and puts an effectual barrier to the further extension of the morbid action. I cannot see any reason why practitioners should still continue to apply caustics in these cases, when the knife is so much more prompt and effectual in its action. If the dead tissues are slow in coming away, their extrusion may be expedited with the scissors, the surface of the ulcer being well touched immediately afterwards with the dilute acid nitrate of mercury, or nitrate of silver, to promote the formation of healthy granulations. As soon as this has been brought about, the part is dressed with some mild unguent, as the opiate cerate, or ointment of the balsam of Peru.

After recovery, the tendency to a recurrence of carbuncle, which is sometimes very strong, should be counteracted by attention to diet, a proper regulation of the secretions, and the avoidance of exposure to cold and fatigue, aided by an alterative course of iodide of potassium, the dose of which should not exceed two grains and a half thrice in the twenty-four hours. If there has been much disorder of the secretions, a very minute quantity of bichloride of mercury may be advantageously conjoined with the potassium. When there is marked derangement of the digestive functions, attended with acidity and flatulence, recourse may be had to the chlorate of potassa, given three times a day, in doses of from five to ten grains, until there is manifest improvement in the tone of the stomach and of the general health.

SECT. IV.—GANGRENE AND BEDSORES.

The skin is liable to gangrene, both idiopathic and traumatic, simple and specific, acute, and chronic; but as these several varieties have

already received a sufficient share of attention, nothing need be said respecting them here. There is one species, however, which may be briefly described in this place, inasmuch as no special mention has been made of it elsewhere. I allude to what is called *white* gangrene of the skin; an affection whose true character is still involved in obscurity, nothing that has yet transpired having thrown any light either upon its pathology or treatment.

White gangrene usually comes on without any appreciable cause, or premonitory symptoms, in irregular shaped patches, from one to three inches in diameter. The sloughs are of a dead, milky color, and of a hard, dryish consistence, yielding little, if any, moisture on pressure. Any portion of the body may be the seat of this affection; but observation has shown that the arms, back, and chest are the regions most frequently implicated. The disease has hitherto been observed chiefly in old persons of a broken, anemic constitution. The treatment is to be conducted upon general principles, special reference being had to the improvement of the health by tonics, brandy, and nutritious diet.

Bedsores.—There is another variety of gangrene of the integuments which, from the frequency of its occurrence, and the severity of the attendant suffering, merits special attention here. The immediate cause under whose influence it is developed is steady and protracted pressure, impeding, and generally arresting, the circulation; hence it is exceedingly liable to arise on the sacro-lumbar region, the iliac projections, on the nates, and over the great trochanter, in consequence of long-continued confinement to one particular posture, as happens in typhoid fever, in severe fractures and wounds, and after surgical operations. Persons who have received violent injuries upon the back, eventuating in paralysis of the lower extremities, are more than commonly prone to this variety of gangrene, or bedsore, as it is usually called. I have at this moment under my charge a tall young man, affected for the last six months with paraplegia, who has a large and excessively painful ulcer upon the left buttock, merely from the pressure sustained in sitting on a chair.

The disease is always necessarily preceded by inflammation, but in consequence of the absence of the usual symptoms, the want of proper care in examining these parts and keeping them clean, or the impossibility which the patient experiences in communicating a knowledge of his suffering, as when he is exhausted by typhoid fever, or other causes, it does not always attract attention until great mischief has been done, eventuating in extensive sloughing, and the establishment of painful, irritable ulcers, which it is often extremely difficult to heal. In some instances the first intimation which the patient has of the approaching mortification is a sense of prickling in the affected parts, as if he were lying upon some rough substance, as sawdust, or coarse salt. At other times, he feels severe pain, of a stinging, burning, or biting character, within a few days after he has been exposed to the pressure, and which is often so constant and distressing as to deprive him both of appetite and sleep. Upon examining the parts to which the suffering is referred, the surgeon finds that they are red,

slightly swollen, congested, and excessively tender on pressure. Ulceration, if it have not already taken place, will be sure to begin in a short time, unles suitable measures are adopted for the patient's relief, and will be speedily followed by mortification, or mortification may take place without being preceded by ulceration.

The extent to which the gangrene may proceed is variable; we occasionally see it occupying an immense surface, perhaps as large as the crown of a hat, and reaching down to the very bones; at other times it is more limited both in diameter and depth, laying bare merely the muscles, or being even in great degree confined to the skin. In rare cases, the ravages are not limited to the soft structures, but involve also the osseous tissue.

The *treatment* of bedsores, or gangrene from pressure, is prophylactic and curative. In the first place, whenever there is any probability from the nature of the case that the confinement is destined to be a tedious one, and attended with constant decubitus, or a helpless state of the patient, means should be promptly adopted for hardening those parts of the surface which long experience has taught us as being most likely to suffer under such circumstances. For this purpose they should be brushed once or twice a day with tincture of iodine, at first diluted, and then pure, or washed repeatedly with a saturated solution of alum and tannin. The greatest possible attention should be paid to cleanliness, and to the arrangement of the sheets and clothes, that they may not be rolled up under the body, and thus become a source of suffering and disease, as too often happens in the hands of careless and thoughtless practitioners. As to the use of plasters, I have very little patience with them; for, unless they adhere well, they are extremely apt to become rumpled, much to the detriment both of the part and system. Change of posture should receive early attention, though this is not always practicable, from the inability of the patient to maintain himself in any other situation than that on the back. When the patient can afford it, he should use an air bed.

The moment any decided suffering is experienced, or the parts become red and inflamed, an air-cushion should be provided for the purpose of equalizing the pressure, or, in the absence of this, an ordinary cushion, with a suitable central hole, the edges being broad and well padded with wool or horse-hair. Such a contrivance, however, is a very imperfect substitute for the air or water cushion, which should therefore always have the preference.

When gangrene is threatened, the best application is the tincture of iodine, aided, if there be much pain and tension, by one or two moderately free incisions, and followed by a yeast, or port-wine poultice, sprinkled with laudanum, morphia, or powdered opium. Cleanliness is promoted by the liberal use of the chlorides and by the early removal of the sloughs. When granulations begin to spring up, the best dressing will be opiate cerate, or balsam of Peru ointment.

SECT. V.—BURNS AND SCALDS.

There are few accidents which are of more common occurrence than burns and scalds, or which entail a greater amount of suffering and deformity. The progress of civilization, and the improvements in the arts and sciences, have greatly multiplied their frequency and severity, and call for corresponding attention on the part of the surgeon. From what I have seen of these lesions, I am satisfied that few practitioners understand their character, or treat them with the success of which they are capable. One reason, perhaps, of this is that every one has a remedy for them, and that hardly any two agree as to the kind of treatment best adapted to their relief.

Burns and scalds differ from each other simply in this, that the one is the result of dry heat, and the other of moist. They both present themselves in various degrees, from the slightest erythematous blush of the skin to the total destruction of all the structures of a limb. Their extent also is exceedingly variable, both as it regards their depth and their superficial area. Thus, while in one case they may involve only a little patch of skin hardly the size of half a dime, in another they may occupy an immense extent of surface; or, instead of being diffused over a large space, the injury may be concentrated upon a small spot, but penetrate to a considerable depth. These differences are of great practical importance, on account of the influence which they exert upon the issue of the case. The division of Dupuytren of burns and scalds, so generally adopted at the present day, seems to me to be most complex and unscientific, and therefore well calculated to embarrass the progress of the inquirer. No one can doubt that the more simple the arrangement of a subject is, the more easily, in general, it is understood. In accordance with this idea, I shall describe burns and scalds as consisting of two classes, the simple and complicated; comprehending under the former term those lesions which, however extensive, produce only inflammation, and under the latter those which cause the death of the parts, either on the instant, or within a short time after their infliction.

Burns are most common in winter, among the poorer classes, who are very liable to have their clothes set on fire in consequence of the manner in which they crowd around the hearth and grate to keep themselves warm. Women, on account of the peculiarity of their occupation, are more subject to them than men, and children than grown persons. Blacksmiths, plumbers, glass-blowers, and foundry men are particularly exposed in this way. The introduction of gas and camphene has been a fruitful source of these accidents. Scalds, on the other hand, are most common in kitchens, breweries, in different kinds of factories, especially soap and candle, and in all places where steam is employed, whether for domestic or public purposes. On our western waters, where steamboat explosions are of almost daily occurrence, many persons are annually destroyed by the effects of hot water. Those parts of the body which are habitually exposed, as the hands and face, are most liable to suffer both from

burns and scalds, especially the latter, steam often penetrating the clothes in every direction. Dry and moist flame, hot water, and steam often enter the mouth and throat, producing violent, if not fatal, effects. A heated iron has been known to be thrust up the rectum for the purpose of homicide, as in the famous case of James II.

It is well known that different agents possess different degrees of capacity for caloric, and that, consequently, they are capable of producing different effects when brought in contact with the living tissues. Thus, experience has shown that boiling metal will cause a more severe impression than boiling oil, and boiling oil than boiling water. The intensity of the injury, however, is not always in proportion to the relative capacity of the substance for heat; for it is well ascertained that copper will, other things being equal, occasion a more violent effect than iron, although the latter possesses a greater capacity for caloric. This fact can be explained only on the assumption that some articles are not only better conductors of heat than others, but that they adhere more firmly to the surface, thus favoring its protracted extrication. Alcohol and ether, from their great volatility, usually produce only superficial burns.

In the milder forms of these accidents there is merely an erythematous appearance of the skin, such as may be readily produced by exposing the back of the hand for a few moments to a stove, or by applying hot water to it. The discoloration is usually very temporary, but at times it is more permanent, lasting for a number of hours, and being perhaps soon followed by slight vesication. The pain is of a smarting, pungent character, but comparatively trifling, and soon goes off. The constitution remains unaffected.

The application of heat, whether dry or moist, unless sufficient instantly to destroy the vitality of the part, or so slight as to make only the most superficial and transient impression, is always speedily followed by an evolution of vesicles, containing a thin, watery fluid, identical with the serum of the blood, from which it is derived. When the vesicles are more slow in forming, as when they are the product of the resulting inflammation rather than of the immediate effect of the caloric, their contents are, in general, partly fluid and partly solid, the latter consisting either of lymph, or of fibro-albuminous matter. Their volume varies from that of a pin-head up to that of a fist, their number being usually in an inverse ratio to their dimensions. Cases are occasionally met with where the epidermis nearly of a whole limb, or the greater portion of the trunk, is elevated into one enormous blister, establishing a most frightful drainage upon the blood.

The surface around the vesicles is of a scarlet color, more or less tumefied, and exquisitely tender on pressure, or on exposure to the atmosphere. The pain is of a burning, scalding character, and so severe as to cause the most intense agony. The part rapidly swells, feeling stiff and tense, and the pain assumes a throbbing character. Well marked constitutional symptoms are always present, especially if the lesion is at all extensive, and the patient may be delirious, excessively restless, and intensely thirsty.

These injuries are said to be *complicated* when they are attended

with the destruction of the vitality of the part, or some other serious lesion, as a wound, fracture, or dislocation. The loss of life may be limited to the skin and subjacent cellular tissue, or it may extend much deeper, involving muscle, aponeurosis, vessel, nerve, and bone all in one common eschar. Such accidents are never produced in any other way than by burns, as when a person falls into the fire, or gets his limb in a stove, grate, or furnace. Dreadful scalds, however, sometimes occur from the protracted application of boiling fluids, as happens now and then in breweries and soap factories. Under such circumstances, the loss of vitality, although not as extensive as we sometimes find it from the operation of dry caloric, is yet sufficient to be productive of the most terrible ravages. The epidermis comes off in large sheets, no vesicles exist, or only around the border of the injured surface, and the skin is of a dirty grayish, cineritious, or yellowish color, sodden, insensible, and marked, here and there, by a purplish line, indicating the course of a subcutaneous vein.

Besides the pain which invariably attends all burns and scalds, no matter how slight, or wheresoever situated, there is apt to be more or less *constitutional* disturbance, coming on at a variable period after the accident; sometimes immediately, and at other times not for several hours, days, or weeks. When the injury is at all extensive, the patient will have all the symptoms of one laboring under a severe shock. He will feel exceedingly cold, or, perhaps, have violent rigors; the pulse will be small, frequent, and feeble; the respiration will be oppressed; and there will be extreme restlessness, along with great thirst and sickness at the stomach. The patient, in fact, lies in great torture, pale, prostrated, agonized. Reaction taking place, he will have violent fever, a flushed countenance, and a quick, frequent pulse, with a tendency to delirium; pain, of a pungent, burning character, forming all the while a prominent symptom. If the excitement run high, there will be danger of over-action in the part, and of inflammation of some of the internal viscera, of the arachnoid membrane, and of the mucous lining of the bowel. Numerous cases have been published within the last fifteen years going to show that ulceration of the duodenum is one of the most frequent lesions which supervene upon scalds and burns of the cutaneous surface; and, in the more chronic forms of these accidents, the same disease is sometimes widely diffused over the colon, thus accounting for the profuse and obstinate diarrhœa which is so often present under these circumstances.

Among the more common local *consequences* of burns and scalds are, the formation of vicious scars, the adhesion of contiguous surfaces to each other, the retraction of the affected parts, anchylosis of the joints, and various transformations of the cicatricial structures, especially the keloid. The scars, which are often of frightful extent, and horribly disfiguring, possess an extraordinary contractile power, which does not cease for a long time, which it is almost impossible to counteract, and which frequently draws out of place every tissue that is brought under its influence, bone not excepted. Owing to this circumstance, the chin is occasionally drawn down against the sternum, and the lower maxilla singularly changed in shape. The fingers may

be retracted like claws, or, literally buried in the palm, the hand thrown back at a right angle with the wrist, or the forearm drawn up against the arm, which is itself, perhaps, firmly pinioned to the side. Similar effects occur in the inferior extremity. Thus, the foot is sometimes tied to the forepart of the leg, and the leg to the posterior surface of the thigh. In neglected burns of the hand, the fingers are often united to each other, so as to give them a webbed appearance.

Burns and scalds are among the most *dangerous* of accidents. If at all extensive, they often terminate fatally from mere shock of the system, without, perhaps, even the slightest attempt at reaction; or, if reaction should occur, life may afterwards be assailed by inflammation of some internal organ; or death may take place at a more remote period, in consequence of the secondary effects of the lesion. A superficial injury of this kind is generally dangerous in proportion to its extent. Thus, a scald involving an entire limb or the greater portion of the trunk, although merely affecting the external layer of the true skin, is always a most serious accident, liable to be followed by the worst results. On the other hand, the danger is hardly less when the lesion is very deep, although it may not be more than a few inches in diameter. When depth and great extent of surface are combined, the chances are that death will occur without reaction, or, at all events, soon after reaction has taken place, from constitutional irritation. A prognosis, therefore, should not be given without due regard to these circumstances.

These injuries, moreover, are more dangerous in infants and children than in adults, on account of the greater susceptibility of their nervous system. Old persons, too, are very intolerant of them, and are liable to suffer severely both primarily and secondarily. Pregnant females occasionally abort from their effects; and in the intemperate they often lead to the development of delirium tremens and other distressing symptoms. A burn on the neck and scalp is liable to cause arachnitis; of the chest, inflammation of the lung and pleura; of the abdomen, peritonitis and enteritis. Finally, a patient, after having manfully struggled against ebb and tide, as it were, for weeks and months, may finally be worn out by profuse discharge and hectic irritation.

Treatment.—The indications in the treatment of these lesions are, first, to produce reaction and calm the system; secondly, to limit the resulting inflammation; thirdly, to promote the sloughing process, when death has taken place, and to favor the development of granulations; fourthly, to moderate contraction, and prevent anchylosis; and, lastly, to sustain the strength during the wasting effects consequent upon the protracted suffering which so often occurs when the patient has escaped from the primary effects of these injuries.

To raise the system from the *depression* or collapse into which it so frequently sinks, even in comparatively slight burns and scalds, immediate recourse should be had to the exhibition of a full anodyne, along with hot toddy, ammonia, sinapisms to the extremities, and artificial warmth. The quantity of morphia, or whatever form of opium may be used, should be at least double what it is in ordinary accidents, the

system being always, under these circumstances, uncommonly tolerant of the medicine. A large dose will not only be conducive to speedy reaction, but will greatly assist in allaying pain and calming the system. If the shock has been unusually severe, it may be necessary, in addition to these means, to use stimulating injections and to rub the spine with some irritating lotion. In the child and old man care is taken not to urge on the reaction too rapidly, or to give opium without a certain degree of caution, lest the subsequent excitement should overtax the enfeebled brain and heart, thereby leading to visceral effusion. As the circulation comes up, the stronger stimulants are gradually withdrawn, the more simple alone being now trusted to for relief.

The second indication is to moderate the resulting *inflammation*. With this view various remedies may be employed; but what these remedies ought to be is a point respecting which there is still much contrariety of sentiment; nor is it at all probable that the question will soon be settled one way or another. In the milder forms of these accidents the practitioner can hardly go amiss if he employs almost any of the numerous articles that have been recommended by the profession and the people. He will find that, at one time, the part and system are most comforted by cold applications, and, at another, by warm; that to-day the one is borne best, and the other to-morrow; that one patient is benefited by an ointment, and another by a lotion; that in one case he may use moist applications with most advantage, and in another dry; in short, that the utmost diversity obtains in regard to the tolerance of this remedy or that. I am sure that the force of these remarks must often have been felt by every one at all extensively engaged in the practice of surgery. It is not surprising, therefore, as was stated at the opening of this section, that there should still be such a diversity of sentiment in relation to the proper management of these accidents.

Cold applications are chiefly adapted to very young, robust subjects, during the heat of summer, but even then they should not be resorted to without great care, for fear of internal congestion and effusion. The proper plan is to use them only so long as they are grateful and soothing to the system, and to discontinue them the moment they are found to be disagreeable. They may consist simply of cold water, spirits and water, or weak solutions of acetate of lead; and the same articles may be applied warm, care being taken, when the one class follows the other, that the transition is gradual and gentle, not sudden and violent. If the lesion be very slight, the surface may be covered with poultices of scraped potato, apple, turnip, starch, arrowroot, or slippery elm; carded cotton; saturnine unguents; or cloths wet with soap liniment; or a liniment made of lime-water and linseed oil. The latter constitutes the famous application so much used at the Carron Iron Works in Scotland; it is, however, exceedingly filthy and disgusting, and should therefore be discarded from genteel practice. Carded cotton, an American remedy, has always stood high in the estimation of the public, and there are few articles that are more constantly or more advantageously employed in the treatment of burns

and scalds. A remedy from which I have often derived signal benefit in the milder varieties of these affections is the dilute tincture of iodine, in the proportion of one part to two of alcohol. It is only applicable, however, when the skin is unbroken.

In my own practice, I have experienced the most signal benefit in the treatment of burns and scalds from *carbonate of lead*, in the form of white paint; and in 1845 I called the attention of the profession to the subject in a short article inserted in Dr. Bell's Bulletin of Medical Science. Numerous observations made since that time have only served to confirm the views then expressed. From its great efficacy, and the readiness with which it can usually be employed, this mode of treatment deserves to come into more general use. It is not applicable merely to the milder forms of burns and scalds, but it may often be advantageously used, no matter what may be the extent or depth of the injury.

As the lead of the shops is very stiff, and, consequently, unfit for use, my invariable plan is to incorporate with it a sufficient quantity of linseed oil to make it of the consistence of thick cream. Thus prepared, the affected surface is thickly and thoroughly coated with it by means of a large camel-hair pencil, a soft mop, or a small paint brush. If vesicles exist, their contents are evacuated with a fine needle, and the parts are well dried, otherwise, the lead will not adhere. The dressing is completed by covering the painted surface with a layer of carded cotton, or a piece of old muslin or linen, supported by a moderately firm roller. In mild cases, one application of this kind, allowed to remain on four or five days, will usually suffice to effect a cure. In the more severe forms of the lesion, on the contrary, a considerable number may be required. Whenever the dressings become stiff or saturated with secretions, they should be removed, others being immediately substituted.

I have never witnessed any bad effects from white lead paint, applied as here stated, although I have used it very freely in quite a number of cases. In one instance, that of a negro girl, sixteen years of age, who had a most severe and extensive burn of the neck, chest, and abdomen, I maintained the application upwards of five weeks, consuming more than a quart of the lead, without observing the slightest injury. In short, my experience induces me to believe that the treatment is perfectly safe in all cases, whatever may be the extent or depth of the lesion, or the age of the patient. Where a counter-poison, however, is deemed necessary, it will be readily found in the occasional exhibition of a dose of sulphate of magnesia, which, while it keeps the bowels in a soluble state, combines with the lead, forming an inert sulphate.

White lead paint probably produces its good effects in two ways: first, by forming a varnish to the affected surface; and, secondly, by directly obtunding its nervous sensibility. In many cases, it acts literally like a charm; the patient, in a few moments, becoming perfectly calm, and passing, as it were, from torment into Elysium.

In Boston, a plan of treating burns and scalds is used with much advantage, consisting of the application of a thick coating of mucilage

of gum Arabic, which is immediately after well dusted with dry powder, the whole forming a complete defence to the raw surface beneath. Mr. Meadows, of London, has recently recommended, for a similar purpose, a mixture of collodion and castor oil, in the proportion of two parts of the former to one of the latter. The preparation, which may be kept ready for use for any length of time in an air-tight bottle, is applied by means of a camel-hair brush, and is speedily converted into a firm, adherent covering, the thickness of which may afterwards be increased if deemed proper.

Where a stimulant effect is required, as when the parts are in a condition verging upon gangrene, the most eligible dressing, perhaps, is Kentish's ointment, composed of one ounce of basilicon ointment and one drachm of spirits of turpentine, and spread upon strips of old muslin, bound on lightly by a roller; or, instead of this, the surface may be carefully pencilled with a weak solution of nitrate of silver, nitric acid, or acid nitrate of mercury, and then covered with a yeast, port wine, or tannin poultice.

Along with these means, proper attention is paid to the state of the constitution; the bowels are maintained in a soluble state; diaphoretics are given to restore the functions of the skin; and the diet is carefully adapted to the emergencies of the particular case. The internal organs, particularly the brain and lungs, are sedulously watched, the avenues to disease being guarded by leeches and other suitable remedies for preventing inflammation.

If, despite the utmost care and attention, the injury terminates in *mortification*, or if the vitality of the parts was destroyed in the first instance, an effort should be made to check its further progress, and to promote the separation of the sloughs. The most suitable remedies for this object are such as are in use for ordinary gangrene. Fetor is corrected with the chlorides. If the sloughs are very firm, the knife may be used, but not without the greatest caution, lest pain and hemorrhage be induced.

As soon as the sloughs have dropped off, the indication is to promote the development of granulations; a circumstance which often requires much judgment and practical skill. The best remedies are the warm water-dressing, with the use of a very weak solution—not more than two drops to the ounce of water—of nitric acid. Sometimes the calamine cerate is very soothing, and seems to do good when almost everything else fails. If the granulations manifest a tendency to become exuberant, as they are very apt to do, they must be repressed with the scissors, nitrate of silver, and systematic compression, tonics being given to support the system. Cases occur in which these bodies are rendered exquisitely sensitive, the slightest touch being followed by the most lively pain. We usually find that this condition is attended with an irritable state of the constitution, and that, consequently, it requires something more than mere topical medication to get rid of it. A judicious course of anodynes and tonics, with the occasional application of nitrate of silver, and the constant use of an elm poultice, constitutes the proper treatment. Occasionally, no local remedy is so soothing as white lead paint. Whatever means may be employed, it

will be found that they will require to be frequently varied, as one loses its effects another taking its place.

To obviate *deformity* constitutes the fourth indication in the treatment of these injuries. The points to be attended to are threefold: first, to prevent adhesions between contiguous surfaces; secondly, to counteract the tendency to vicious contraction; and, thirdly, to obviate anchylosis.

Allusion has already been made to the tendency which contiguous surfaces have to unite to each other during the progress of these accidents. This tendency is not confined to the fingers and toes, but is exhibited also in other parts of the body, as between the arm and trunk, the two labia, the thigh and scrotum, the ear and scalp. Whenever it appears, it must be carefully counteracted by the use of the bandage and the interposition of lint, aided, if need be, by splints. It does no credit to a surgeon to send forth his patient, after the completion of cicatrization, with webbed hands and feet, or with his arms pinioned to the side of the chest, although such occurrences are not always entirely avoidable.

The disposition to contraction in burns and scalds, attended with loss of substance, is always great, and is often productive of the most frightful deformity. To counteract this disposition, recourse should be had, early in the treatment, to carved splints and tin cases, judiciously applied, and steadily used, not only until the parts are well, but for a long time afterwards; experience having shown that the tendency to contraction continues for months, if not years, after the completion of the cicatrization.

If, from neglect, mismanagement, or unavoidable circumstances, the contraction has seriously impaired the usefulness of the part, or greatly marred the person's beauty, relief should be attempted by the division of the offending cicatrice, or, perhaps, by its excision, the raw edges being afterwards united by suture, or adapted to a flap of integument from the neighborhood.

This operation, constituting what is termed *dermoplasty*, should not, however, be undertaken without due preparation of the system; for it will readily be observed that when the cicatrice is very large, two most extensive wounds will be made, thus inflicting a violent shock upon the constitution, extremely liable to be followed by erysipelas and a low form of fever, under which the patient might easily sink. At least a fortnight should be spent in this kind of preliminary treatment.

The operation should be performed while the patient is under the influence of chloroform, and great care should be taken to dissect out every particle of the inodular tissue. To accomplish this, the surgeon is sometimes obliged to pass deeply among important vessels and nerves, which must, of course, not be interfered with. In conducting such an operation about the neck, the precaution must be used of preventing the entrance of air into the veins. The bleeding which attends the excision of the cicatrice is generally trifling, and is easily arrested by torsion: when the ligature is unavoidable, it should be brought

out at the nearest point of the wound, or through a small opening in the transplanted integument.

The skin for filling up the gap left by the removal of the inodular tissue, should always be taken from the immediate vicinity of the part. Thus, in the neck, it is usually obtained from the shoulder or top of the chest, and, when the wound is very large, two flaps are generally made, one on each side, the object being to guard against sloughing from inadequate nutrition. Due allowance must always be made for shrinkage. Hence, the flap should invariably be at least from one-fourth to one-third larger than the wound, have a good broad pedicle, and be well stitched in its new position, although care must be taken not to place the sutures too near each other for fear of embarrassing the circulation. The central portions of the flap must be loosely confined with adhesive strips, and the edges covered with charpie, soaked in oil. The wound made by the transplantation of the integument is immediately closed in the usual manner. The parts are kept perfectly at rest, being immovably fixed by suitable apparatus, and the case is afterwards managed according to the general principles of plastic surgery.

The results of this operation have been much lauded. I have not, however, I must confess, much confidence in its ultimate efficacy, experience having taught me that, sooner or later, the deformity is sure to return, though not always in its original extent. I have seen enough of these procedures, both in my own practice and in that of others, to convince me that they ought not to be classed among the triumphs of surgery. It is only when the cicatrice is very soft and superficial that they hold out any prospect of a very favorable result. When the contraction affects the muscles, tendons, fibrous membranes, and bones, forcing them out of their natural shape and position, the art of surgery can be of no avail.

Joints often become involved during the progress of burns and scalds, either from direct inflammation, or in consequence of the contraction of neighboring muscles, tendons, and aponeuroses. The parts are carefully watched, being moved from time to time, and constantly retained in splints, until all tendency to anchylosis has ceased.

Finally, the secondary *constitutional irritation* and drainage, so common, and so hazardous in the more severe forms of these accidents, must be met by stimulants, tonics, and anodynes, along with a nutritious diet, and exercise in the open air. The wasting diarrhœa, which is so often present, must be checked with opium and astringents, of which acetate of lead and sulphate of zinc deserve particular mention, the former being given in two, and the latter in one grain doses, with half a grain of opium, three times in the twenty-four hours. Night-sweats are controlled with quinine and elixir of vitriol.

Secondary amputation may be rendered necessary, when, an attempt having been made to save the part, death is likely to happen from the excessive discharge and hectic irritation; or when the part is found not only to be useless but to be greatly in the way of the patient's comfort and convenience.

SECT. VI.—FROST-BITE AND CHILBLAIN.

Man, as is well known, possesses in an eminent degree the faculty of resisting the influence of physical agents. His constitution is able to bear almost any amount of heat and cold, provided the transition from the one to the other is not too great or sudden, and that he himself is at the time in the full enjoyment of his bodily powers. The experiments of Fordyce, Blagden, and others show what an amount of artificial heat may be endured without entailing any serious effects, and the experience of travellers, as Banks, Solander, and Kane, is equally decisive in regard to his capacity of withstanding the effects of low degrees of temperature. It is only, or chiefly, when the alternation from heat to cold is very rapid, or when the application of cold is made in a very concentrated form, upon a part of the body whose circulation is naturally very languid, that severe consequences are apt to ensue. Baron Larrey, who enjoyed extraordinary opportunities of studying the effects of cold, during Bonaparte's celebrated retreat from Russia, was forcibly struck with the little suffering which the soldiers experienced when exposed even for several successive days to the influence of a very low, dry, uniform temperature. Thus, after the battle of Eylau, although the mercury had fallen fifteen degrees below zero of Reaumur's thermometer, none of the French troops complained of frost-bite, notwithstanding many of them had remained in the snow, in an almost inactive state, for upwards of twenty-four hours. Presently, however, a fall of sleet coming on, during which the temperature rose suddenly from eighteen to twenty degrees, immense numbers of those who had been exposed began to suffer from the effects of cold, consisting principally in sharp, pricking pains in the remote parts of the body, especially in the feet, and in a disagreeable sense of numbness and weight. Severe swelling soon followed; the skin assumed a dusky, reddish appearance; the joints became stiff and insensible; feeling and warmth rapidly diminished; and black spots formed on the roots of the toes and on the back of the foot, announcing the occurrence of gangrene, the extremity looking dry and shrivelled, as in chronic mortification. It was observed that those who had warmed themselves at fires suffered more severely than those who had been more discreet in this respect.

The first effect of dry, cold air is a sense of numbness and weight with a peculiar prickling or tingling, and an afflux of blood to the surface, giving it a lively reddish appearance. If the impression be maintained for any length of time, the parts become stiff and perfectly insensible; and the blood, retreating from the surface, leaves it of a pale, whitish aspect, contrasting strikingly with the previous discoloration. When the cold is intense, and suddenly applied, so as speedily to overwhelm the parts, the surface occasionally exhibits a mottled appearance, depending upon the presence of coagulated blood in the subcutaneous veins.

The effects of moist cold are very similar to those of dry cold. Upon immersing the hand, for instance, in iced water, there is gene-

rally an immediate rush of blood to the surface, and a decided augmentation of its color, soon succeeded by an unpleasant tingling sensation and a marked degree of numbness. By and by, however, the surface becomes white, the skin contracts, exquisite pain arises, and the whole limb sensibly shrinks. There is thus, in fact, no essential difference in regard to the effects of these two varieties of cold; and the reader cannot fail to observe how closely the first impressions of both resemble those produced by the application of artificial heat, especially in its dry form.

All parts of the body are liable to suffer from the effects of cold; excepting, however, those rare cases, where the impression has been maintained for an unusual length of time, the toes, feet, heels, fingers, hands, nose, and ears, together with the lips and cheeks, will be found to be more frequently affected than any other parts. Accidents of this description are most common among the poorer classes, those wretched beings whose system is broken down by starvation, intemperance, and every kind of exposure and hardship, calculated to depress the vital powers, and predispose to the development of disease. Sailors and the boatmen on our lakes and rivers are particularly prone to frost-bite, and there are few seasons that do not furnish a large supply of such cases.

The primary effects of cold upon the general system are those of an agreeable stimulant; the circulation is increased in force and frequency, a slight glow pervades the surface, and the individual is universally exhilarated. By and by, this agreeable feeling is changed into one of pain and torpor; the brain is oppressed as if under the influence of a powerful narcotic; the whole body is cold and benumbed; and the person, overwhelmed by drowsiness, is obliged to make the most powerful efforts to keep awake. If, in an unlucky moment, he should yield to his inclinations, away from friends and assistants, he sleeps to wake no more; the blood rapidly settles in the internal organs; the nervous fluid ceases to be generated; the respiration becomes heavy and stertorous; and death takes place very much as in ordinary apoplexy. Should the individual, after long and severe exposure, be suddenly brought into a hot room, or placed near a fire, he will run the risk of speedily perishing from asphyxia, brought on by the repulsion of the blood to the brain and lungs; or, should he survive a short time, the frost-bitten parts will be seized with gangrene, the spread of which, as observed by Larrey, is often so rapid and striking as to be perceptible by the eye.

Such are some of the more important local and constitutional effects of cold, when applied in its more severe and protracted forms. As just seen, it may prove destructive both to the part and system. Or, reaction taking place, the patient may recover, although he will be likely afterwards to suffer more or less in various parts of the body, especially the feet, ears, nose, and fingers, from the secondary effects of his accidents, which are often as distressing to him as they are perplexing to the practitioner.

The *treatment* of frost-bite requires no little judgment and adroitness to conduct it to a successful issue. The great indication is to

recall the affected parts gradually to their pristine condition by restoring circulation and sensibility, in the most gentle and cautious manner, not suddenly, or by severe measures. The first thing to be done is to immerse the part in iced-water, or to rub it with snow, the friction being made as carefully and as lightly as possible, lest over-action be produced in a part necessarily greatly weakened. If no ice or snow be at hand, the coldest well water that can be procured must be used; and if immersion be inconvenient, wet cloths are applied, with the precaution of maintaining the supply of cold and moisture by constant irrigation. Moderate reaction is aimed at and fostered. All warm applications, whether dry or moist, are scrupulously refrained from; the patient must not approach the fire, immerse his limbs in hot water, or be even in a warm room. Attention to these precepts is of paramount importance, and should on no account be disregarded, since its neglect would be almost certainly followed by mortification or other disastrous consequences.

As soon as the natural temperature has been in some degree restored, slightly stimulating lotions will be found serviceable, such as weak solutions of camphor, soap liniment, or tincture of arnica with the addition of a few drops of ammonia to each ounce of fluid. The parts are placed at rest, in an easy and rather elevated position, and lightly covered with a blanket, or, what is better, exposed to the warm air of the apartment, there being now no longer any necessity of keeping the patient in a cool room, as there was in the earlier stages of the treatment. Some mild cordial may now also be given in small quantity, and the patient may eat a little warm gruel or panado. If the local reaction threaten to be severe, it must be checked by astringent and cooling lotions, by attention to position, a properly regulated diet, and the exhibition of a purgative. For incipient mortification, consequent upon cold, the best remedy is dilute tincture of iodine.

Dr. Hayes, the companion of Dr. Kane, in his last Arctic voyage, gives an account of a mode of treatment of frost-bite pursued by the Esquimaux, which deserves brief mention, although it does not differ essentially from that just laid down. A native, says the writer, who had his leg frozen above the knee, to such an extent that it was stiff, colorless, and apparently lifeless, was placed in a snow-house at a temperature of 20° below zero. The parts were now bathed with ice-cold water for about two hours, and then enveloped in furs for about twice that period. At the end of this time frictions were commenced, first with the feathery side of a bird skin, and then with snow, alternately wrapping the limb in furs, and continuing the rubbing for nearly twenty-four hours. The limb was now carefully covered, and the temperature of the room elevated by lamps above zero. On the third day the man was removed to his own house, and in seventy hours he was able to walk about, with only a slight frost-bite on one of his toes.

When a person has been overpowered by cold, or is nearly frozen to death, the attempts at restoration must be conducted upon the same general principles as when he is suffering merely from the local effects of cold; that is, he should be put in a cool room, and be gently but

efficiently rubbed with flannel, wet with brandy, spirits of camphor, or ammoniated liniments, gradually followed by dry frictions and warm covering. If he can swallow, brandy should be given by the mouth, or this or some similar article should be thrown into the rectum; stimulants should be cautiously applied to the nose, especially snuff, and sinapisms to the precordial region, the stomach, and spine. As the circulation and respiration improve, the temperature of the apartment may be gently elevated, and warm broths, or wine-whey, or, what is better, warm toddy administered. The efforts at resuscitation should not be discontinued too soon, since they have occasionally been crowned with success long after all reasonable expectation of recovery had ceased. The practice formerly recommended of immersing the whole body in cold water, under these circumstances, cannot be too much deprecated, as it cannot fail to prove exceedingly injurious.

Pernio, or Chilblain.—The secondary effects of cold are usually described under the name of pernio, or chilblain, and there are several varieties of form in which they may present themselves, as the erythematous, ulcerated, and gangrenous. These effects may supervene upon slight exposure, and hence they are occasionally met with among our better class of citizens, the parts most liable to suffer being the toes, heel, instep, ears, nose, and fingers. They are usually preceded by slight vesication, and by burning, tingling sensations, as if the surface had been held near the fire. These effects may soon subside, or they may prove a source of annoyance for many months; in general, however, they are of a transient nature, but the parts, instead of getting completely well, remain weak and congested, and are liable to new attacks of suffering from the slightest causes. Any sudden change in the weather is extremely prone to bring on a paroxysm; the affected structures become red, or of a dusky purplish hue, swollen, painful, and œdematous; the epidermis is often raised into little blisters, distended with yellowish, or sanguinolent fluid; and there are few cases in which itching, sometimes almost insupportable, is not a prominent symptom, the patient feeling as if he could tear the parts to pieces.

Ulcers not unfrequently form, as an effect of frost-bite; generally preceded by slight vesication, they are superficial, irritable, and indisposed to heal, the discharge being of a thin, ichorous character; the parts around are red, inflamed, and congested, and the erosive action often spreads over a considerable surface. In some cases it extends very much in depth, and may thus ultimately invade a neighboring joint, bone, tendon, or muscle.

Gangrene is more frequently a primary than a secondary effect of frost-bite; the affected part is of a dark brownish, or blackish color, cold, insensible, and exquisitely fetid; in some cases the slough is dry and shrivelled, like a rotten pear; in others, it is moist and expanded. In persons of weak constitution, and in the more remote parts of the body, where the circulation is naturally very feeble and languid, it often spreads to a considerable extent; but in general its tendency is to limit itself to a small space. When considerable, it may invade all the component tissues of a limb, the soft parts as well as the bones and joints.

Pernio may, as already stated, last for many years, alternately disappearing and recurring under the slightest local and constitutional changes. Atmospheric vicissitudes generally exercise a marked influence upon these attacks, the patient being often a complete barometer; a combination of cold and moisture is particularly prejudicial. During the dry weather of summer the disease not unfrequently goes off spontaneously, but is sure to return on the approach of winter. In this manner life may be rendered perfectly miserable, especially when the chilblain is seated in the feet, the patient being hardly ever able to walk about with any degree of comfort or satisfaction.

The *treatment* of pernio is generally too little regarded by the practitioner, who, knowing that it never endangers life, is too apt to overlook its just claims to his sympathy. Of the various remedies that have been, from time to time, recommended for its relief, those that are of a slightly stimulating character are most entitled to confidence. The milder forms of the disease may often be promptly relieved by immersion of the part in cold, or ice water, followed by a pretty strong solution of acetate of lead and opium, or, what is preferable, the dilute tincture of iodine, which, on the whole, I have found to be more beneficial than any other article. Sometimes prompt relief follows the application of carded cotton, soap liniment, spirits of camphor, or some other stimulating embrocation.

When blisters form they should immediately be opened, and the affected surface freely touched with solid nitrate of silver, or painted with tincture of iodine. Not unfrequently excellent effects follow the use of the dilute citrine ointment, or ointment of the oxide of zinc. In obstinate cases I have derived great advantage from a blister, retained until thorough vesication was produced.

The gangrenous form of pernio must be treated upon general principles. Fetor is allayed by the chlorides, and sloughs are removed as they become detached. Amputation is refrained from until there is a well-marked line of demarcation.

In all cases proper attention must be paid to the general health; the diet must be regulated, the bowels evacuated, and the secretions improved and restored. There is reason to believe that great temporary suffering is often induced by neglect of these precautions.

SECT. VII.—MORBID GROWTHS.

The skin is subject to a variety of morbid growths, some of a benign, others of a malignant character. Among the more simple formations belonging to the former class are warts, corns, horny excrescences, and the so-called sebaceous tumor, which, as its name implies, has its seat in the sebaceous follicles, so common in different regions of the cutaneous surface. Fibrous, fibro-cellular, or fibroplastic growths are also sometimes met with, although they are infrequent; they are never malignant, but are extremely apt to return after extirpation. The most common and interesting development of this description is what is termed the keloid tumor, incidentally re-

ferred to in the chapter on the general history of morbid growths. Finally, the skin is occasionally remarkably hypertrophied, either congenitally, or as a result of interstitial deposits.

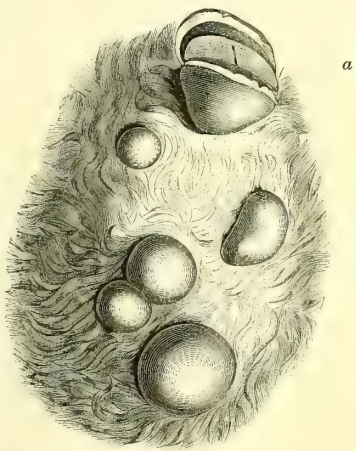
The number of malignant growths of the cutaneous tissues is quite considerable, and, as they are of frequent occurrence, and often followed by disastrous consequences, it becomes necessary to study them with more than ordinary care and attention. The principal affections, recognized by pathologists as appertaining to this class of diseases, are scirrhus, melanosis, eiloid, lupus, epithelioma, and the peculiar bark-like formation, first described by Dr. Warren under the name of lepoid.

1. SEBACEOUS TUMORS.

The sebaceous tumor, essentially consisting of an enlargement of a sebaceous gland with a retention of its secretions, has been described under various names, founded either upon the character of its walls, the fancied nature of its contents, or the kind of structure in which it originates; as encysted, atheromatous, meliceric, steatomatous, and follicular. Wen was the familiar appellation by which it was known by the older surgeons. The term sebaceous, being expressive of the true situation of this variety of tumor, seems to me to be preferable to any other, and I shall therefore retain it on the present occasion.

The manner in which the sebaceous tumor is formed is easily explained. The first link in the morbid chain is the obstruction of a sebaceous gland, or cutaneous follicle, either in consequence of adhesive inflammation, or the inspissated condition of its own secretion, thereby offering a mechanical impediment to its escape. Being thus forcibly retained, the matter gradually increases in quantity, and as it does so it necessarily presses everywhere upon the walls of the gland, which, in time, expands into a strong sac, varying in size from that of a pea up to that of a small orange (fig. 149). Essentially, then, the tumor is an encysted tumor, consisting of an enlarged, or hypertrophied condition of the sebaceous gland, and of an altered state of its own secretion, both the direct and inevitable result of the closure of the natural outlet preventing the evacuation of the affected structure.

Fig. 149.

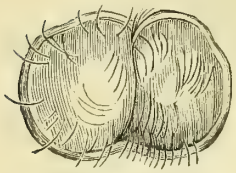


Sebaceous tumors of the scalp. *a*. A tumor laid open to show its cyst and contents.

The *contents* of the sebaceous tumor are extremely variable, both in color and consistence; in general, they are thick and whitish, looking and feeling very much like a mass of lard or tallow; occasionally they present the appearance and consistence of honey; and cases are met with in

which they bear a very close resemblance to putty, or a thick mixture of flour and water. Sometimes the contents of a tumor of this kind are thin, almost watery, and exceedingly offensive. At other times, again, short hairs, very soft, and having well-formed roots, are found in them, as represented in the annexed sketch (fig. 150).

Fig. 150.



Cyst of a sebaceous tumor, with hairs in its interior.

Pilous matter is most commonly found in sebaceous tumors about the forehead and eyelids. I have repeatedly seen it in these situations, and in several instances in very young subjects. It is not likely that the hairs that are found here are developed in the morbid growth; on the contrary, the probability is that they are intercepted during the process of occlusion of the cutaneous follicle, and that, after they have fallen into the cavity of the cyst, they are capable of attaining a certain development, but ultimately cease to grow, and so become effete matter.

The sebaceous tumor sometimes contains *calculous matter*, either in part, or in whole; consisting of phosphate and carbonate of lime, cemented together by a minute quantity of animal substance. A case has been recorded where the integuments of the buttocks were completely studded with small collections of this description; they occurred in a young lad, and evidently had their seat in the skin-follicles. Similar formations have been observed on the forehead, scalp, nose, shoulders, trunk, and scrotum.

The *cyst* of this variety of tumor, at first very thin, soft, and delicate, becomes, in time, quite thick and dense, often resembling a fibrous membrane; and instances are occasionally met with, although they are rare, in which it is transformed into fibro-cartilage, cartilage, and even bone. In cases of long standing, its thickness is sometimes very remarkable. Externally the cyst is rough, and more or less intimately connected with the surrounding parts by cellular tissue, which is not unfrequently considerably condensed; internally, on the contrary, it is generally smooth and glistening, very much, for example, like the inner surface of the dura mater. Small sacs are sometimes observed in its interior, and I have several times seen indistinct partitions thrown across it, the result, apparently, of plastic, organized deposits.

The sebaceous tumor has but few vessels, and even these are always very small; hence its progress is invariably tardy, and its removal is never attended with any hemorrhage. Little or no pain accompanies its development; and it never manifests any malignant tendency. Sometimes, however, it ulcerates, and becomes the seat of a good deal of local irritation and of a highly disagreeable, offensive discharge. When seated on the scalp, the steady, persistent pressure of such a tumor may occasionally partially indent the osseous tissue, as I have seen in several instances that have fallen under my observation. Although the diseased follicle is originally situated in the substance of the skin, the cyst, as it increases in size, gradually pushes itself beneath it, so that the connection between them is ultimately completely destroyed.

Meanwhile, the skin itself becomes attenuated, and often, in great measure, deprived of hair, especially when seated on the scalp, where, particularly in cases of long standing, the surface is often quite bald.

The degree of *mobility* of the morbid growth is extremely variable, depending upon its age and volume, but, above all, upon the amount and laxity of the cellular tissue in the structures in which it is developed. Its shape is for the most part globular; but when it is subjected to considerable pressure, it is not uncommon for it to have a compressed, flattened appearance.

The most common *sites* of the sebaceous tumor are the face, forehead, and scalp. It is also met with on the neck, eyelid, shoulder, back, buttock, and scrotum. On two occasions I have seen it on the prepuce, the patients being small boys who had been circumcised at the usual period at which that operation is performed according to the rites of the Jewish Church. It is very seldom that the sebaceous tumor is found on the extremities.

The *number* of sebaceous tumors, although usually small, is extremely variable. Sometimes there is only one, but it is not at all uncommon to see as many as five or six on the same person. In one instance, that of a man aged forty, I counted upwards of two hundred, most of them being situated upon the head, face, and neck. Nearly all began when he was quite young, soon after bathing in cold water. They were of the meliceric kind, the contents of many being visible at the enlarged and partially obstructed follicle, where they had concreted, and presented a yellowish, dirty, wax-like appearance. They were of a globular or ovoidal shape, and varied in volume from that of a pea up to that of a hen's egg.

Occasionally these tumors occur in several members of the same family; and now and then they display an evident *hereditary* tendency, as in a case which fell under my observation in 1844, in which the disease existed upon the scalp of a young woman of twenty-seven, and also upon that of her father, a paternal aunt, and her paternal grandmother. The tumors were, respectively, from four to seven in number, and varied in volume from that of a marble to that of a walnut. More recently two other instances of a nearly similar character have come under my notice.

The *diagnosis* of the sebaceous tumor is sufficiently easy. Its chronic march, indolent character, soft, doughy consistence, mobility, and subcutaneous situation, together with the absence of enlargement of the subcutaneous veins, and the normal appearance of the skin, always serve to distinguish it from other morbid growths.

The only *remedy* for this variety of tumor is thorough excision, care being taken that not a particle of the cyst or wall be left behind, otherwise repullulation, to a greater or less extent, will be inevitable. If the tumor be situated upon the scalp, a single longitudinal incision may be made across it, the flaps being dissected off from each side, and the morbid mass lifted out bodily, without exposing its contents. In most other regions, however, the best plan is to lay the tumor open from within outwards, turn out its contents, and then tear away the cyst. When the integuments are diseased, it may be proper to include the

altered structures in an elliptical incision. However performed, the operation should never be undertaken without some preparation of the system, as I have repeatedly known it to be followed by erysipelas.

2. MOLLUSCOUS TUMORS.

There is a form of cutaneous tumor, to which, from its fancied resemblance to the knots on the bark of the maple, the term molluscous has been applied. When fully developed, it is about the size of a ripe currant, which it further resembles by having a central depression upon its surface, caused by the peculiar arrangement of its contents. Their form is variable; some are round or oval, some elongated, and as if compressed, some pedunculated, and some wallet-shaped. In color, they are usually red, reddish brown, or dusky yellowish; in consistence, soft and spongy.

Molluscous tumors occur upon various parts of the body, as the face, neck, back, shoulders, nates, and extremities, and often exist in such immense numbers as to constitute a genuine molluscous diathesis. What is singular is, that they are sometimes met with in several members of the same family; a circumstance which, together with their rapid and consentaneous development, has led to the idea of their being occasionally contagious, or communicable from one person to another by contact. Whether this, however, is really so or not remains to be proved.

The disease, although it has been noticed at a very early period, as in children under five years of age, is most common in adult and elderly subjects. Its progress is frequently very rapid, a large portion of the surface becoming studded with tumors in a few weeks. How the disease is excited we are uninformed, nor is anything known of its predisposing causes. The immediate influence under which it is developed is inflammation of the sebaceous glands, giving rise to a rapid secretion of sebaceous matter, which, becoming too thick to escape at the natural outlets, accumulates in the interior of these reservoirs, pressing asunder their walls, and giving them a lobulated appearance, as is rendered evident on a section of them.

The *contents* of these little tumors consist mainly of epidermic scales, in union with ovoid, oblong, or cuboid cells, heaped together like a pile of eggs, and occupied either by granular matter, oil globules, or a peculiar homogeneous substance, of whose nature we are ignorant.

Left to themselves, molluscous tumors nearly always pass into ulceration, generally beginning at their summits, and gradually progressing until their contents are completely discharged, when the parts usually readily heal; or they are invaded by gangrene, which occasionally extends deeply into the subjacent tissues, and thus leads, in the event of recovery, to disfiguring scars. Finally, cases occur in which the tumors become atrophied, or transformed into little pendulous, wart-like excrescences.

The *treatment* of these molluscous formations is best conducted by the topical use of stimulants, of which the most efficacious are tincture of iodine, acid nitrate of mercury, sulphate of copper, chloride of zinc,

and chromic acid, all more or less diluted to adapt them to the exigencies of each particular case, or the tolerance of the parts, the object being rather to produce a sorbefacient than an escharotic effect. In general, it will be found that brushing the surface of the tumor over freely once a day with the tincture of iodine will not only promptly arrest its development, but rapidly promote its removal. Laying open the morbid growth, and touching the raw surface slightly with the solid nitrate of silver, is a plan highly recommended by some practitioners. The most expeditious method of all, however, is to cut it away with the knife, or to effect its strangulation with the ligature; but it is obvious that such a procedure can only be adopted with any degree of propriety when the number of tumors is very small.

Constitutional treatment is not to be neglected in this disease. Occasionally the molluscous tumor has in great degree, if not entirely, disappeared, simply under the influence of a change of air, a judiciously regulated diet, and attention to the bowels and secretions. When the general health is much disordered, the first object should be to amend it by the interposition of suitable remedies, medicinal and hygienic. Cleanliness is of great importance, and must not be overlooked. If there be a scorbutic state of the blood, iron and quinine, with sub-acid drinks and vegetables, will be indicated.

3. MOLES.

Moles are congenital spots, occurring upon various portions of the external surface of the body, usually of a dark, grayish, blackish, tawny, or brownish color, and closely covered with short, thick, almost bristly hairs. They occasionally project somewhat above the surrounding level, but in general this is not the case; they are usually a little harder than the natural skin, and they present themselves in various forms, of which the round and oval are the most common. Some persons seem to be remarkably prone to the formation of moles, and when this is the case it is not uncommon to see a number of them scattered over different parts of the body. When single, or existing in small numbers, they generally occur on the face, shoulder, neck, or arm. Their size varies from that of a three cent piece to that of a dinner-plate.

The color of these spots is due to a redundant deposit of the natural pigment of the mucous network of the skin, with an altered condition of the proper substance of the dermis, and probably also of the cuticle and of the hair follicles.

Long continued local irritation, such as is caused by friction, pressure, or the want of cleanliness, may occasionally awaken ulceration in these bodies; but in general they remain perfectly stationary and innocuous. A few years ago, I excised a mole from the back part of the arm of an old gentleman, of upwards of eighty, which had been a source of annoyance to him, more or less, for thirty years. It had latterly become ulcerated, had often bled, and was the seat of a very fetid, nasty discharge. It was included in an elliptical incision, the parts healing kindly, and there being no return of the disease.

It is not often that moles become the subjects of surgical interference; it is only, in fact, when they cause serious disfigurement, or when they fall into ulceration, that professional aid is sought. It has been proposed to get rid of them by mild caustic applications, as solutions of ammonia or caustic potassa; but as such a procedure might be followed by the development of keloid, the best plan always is to remove them with the knife, the morbid structures being included in an elliptical incision, the edges of which are afterwards healed, if possible, by the first intention.

4. HYPERTROPHY OF THE SKIN.

Hypertrophy of the skin is now and then observed, chiefly, if not exclusively, as a congenital affection. It is characterized by a soft, pendulous condition of the skin, which hangs off in loose folds from the surface to which it is naturally attached, as if it had been stuck on without any special object. In all other respects, the integument is apparently perfectly normal, there being not the slightest alteration of color, consistence, or structure, at least so far as we are enabled to judge from inspection. The most common sites of hypertrophy of the skin are the nates, scrotum, prepuce, and vulva. The most remarkable example that I have met with occurred on the back of the neck in a female child, upwards of a year old, as the result of a congenital vice; the integument formed a large pendulous mass, of a doughy, inelastic feel, extending from ear to ear, and causing a very unseemly deformity. The child was in other respects well formed, and, with this exception, remarkably beautiful.

When the hypertrophied integument forms an unsightly mass, or when it proves inconvenient by its bulk, the surgeon will be appealed to for advice, and under such circumstances it may become necessary to remove the offending structures. For this purpose, the parts should, if possible, be included in an elliptical incision, care being taken not to cut away so much of the skin as to interfere with reunion. If the tumor be very large, and the patient of tender age, recourse to the knife should be postponed until the constitutional stamina are sufficiently developed to enable the child to bear the shock attendant upon so severe an operation. Special pains should be taken to guard against hemorrhage.

5. ELEPHANTIASIS, OR HYPERTROPHY OF THE SKIN AND CELLULAR TISSUE.

Arabian elephantiasis, Egyptian sarcocele, or the glandular disease of Barbadoes, as it is variously denominated, although uncommon in this country, deserves passing notice on account not less of the hideous deformity which it induces than its obstinate and intractable character. The favorite seat of this singular disease is the leg, which often acquires an enormous volume, and a most grotesque appearance, causing a striking resemblance to the leg of the elephant, whence its name. It is not, however, confined to this part of the body; on the contrary, it is

liable to occur in various organs, particularly the scrotum, prepuce, and pudendum, which, in consequence, sometimes acquire an enormous bulk. A tumor of this kind, presented to me by Dr. Bozeman, of Alabama, and removed by him from the genital organs of a negro, weighed forty pounds; and Clot-Bey extirpated one, occupying a similar situation, which weighed one hundred and ten pounds. The adjoining cut (fig. 151) affords an illustration of this disease as it manifests itself in the foot and leg.

Fig. 151.



The disease is met with in both sexes, but much oftener in men than in women; it occurs in various races of men, and frequently begins at an early age, although it is most common in young adults. In this country and in Europe the affection is very rare, but in certain parts of Asia, Africa, Syria, Arabia, Egypt, and the West Indies, it is extremely prevalent and sometimes observes an endemic tendency.

Of the *causes* of elephantiasis nothing satisfactory is known. The disease is evidently of an inflammatory character, but how this is brought about we are entirely ignorant. It has been supposed that it is owing to an obstruction of the principal veins of the affected parts, impeding the return of blood, and thus creating congestion and irritation, followed by plastic exudation in the interstices of the cutaneous and cellular tissues. From the fact that attacks of erysipelas are not uncommon in the earlier stages of the disease, or, rather, that this affection not unfrequently precedes the outbreak of elephantiasis, it has been imagined that it is essentially dependent upon the disturbance which it occasions in the nutritive and secretory functions of the parts. Others, again, have been led to conclude that the malady essentially consists in an inflammation of the lymphatic vessels, attended with plastic deposits within and around these vessels, whereby their caliber is choked up, and, as a necessary consequence, their contents are prevented from discharging themselves into the thoracic duct. This view is, on the whole, extremely plausible, for it really comprises all the cardinal elements of a consistent theory, which the others certainly do not. That there is, in this disease, serious mechanical obstruction of some kind or other, is unquestionable, and I know of none that would be more likely to produce such a result than compression of the lymphatic vessels. If, then, it is allowable, in the existing state of the science, to frame a doctrine in respect to the origin of an affection so obscure as elephantiasis is acknowledged to be, we may conclude that it is an inflammation of the absorbents, attended with obstruction of their caliber, and deposits of plastic matter, which, becoming gradu-

ally organized, is ultimately converted into an analogous fibrous tissue, thereby completely changing the character of the primitive structures, especially the cutaneous and cellular.

If the affected structures be carefully examined by *dissection*, the following appearances will be observed: The epidermis is very much thickened, rugose, and so firmly adherent as to come off with difficulty. The true skin is of a whitish color, striated in its texture, and very hard and dense, cutting almost like the rind of bacon. In many cases it is from a quarter of an inch to half an inch in thickness. The papillæ are enormously hypertrophied, and of an elongated shape, forming large bodies which stand off prominently from the substance of the true skin. The cellular tissue is completely changed in its character; its areolæ are obliterated, and their place is supplied by a dense, inelastic fibroid substance, exhibiting none of the properties of the original. In elephantiasis of the leg, the muscles, compressed by the new matter, and deprived of activity, are found to be wasted, pale, and in a state of fatty degeneration. The bloodvessels are generally very much enlarged, and hence, when an attempt is made to extirpate the morbid mass, as when it occupies the genital organs, tremendous hemorrhage is to be expected. In some cases, however, the larger veins are obliterated, especially in elephantiasis of the lower extremity. The principal nerves have a white, flattened appearance, and are apparently augmented in size.

Elephantiasis often, if not, indeed, generally, comes on suddenly and unexpectedly, without any apparent local or constitutional cause. At times, however, its development is directly traceable to local injury, as a blow, sprain, or contusion; and in quite a number of cases it has seemingly followed upon the protracted immersion of the parts in cold water, the occupation of the individual compelling him to pursue such a habit. The symptoms are, at first, of an inflammatory character; the affected surface, red and painful, pits on pressure, and imparts a nodulated, cord-like sensation to the finger; the subcutaneous cellular tissue is hard and infiltrated; and the movements of the diseased structures soon become stiff, awkward, and embarrassed. Sometimes red lines or streaks extend along the course of the lymphatic vessels, as high up as the nearest ganglions, which are themselves more or less tender and swollen. Considerable febrile commotion is generally present, but this soon subsides, and the disease gradually lapses into a chronic state, which often ceases only with the patient's life.

The *diagnosis* of elephantiasis is unmistakable; there is no other affection which bears any resemblance to it. Once seen, it can never be forgotten. The part is not only enlarged, but enormously increased in weight and consistence; it feels heavy and cumbersome, and is as hard, dense, unyielding, and rough as the leg of the animal from the resemblance to which it has derived its name. The surface of the skin, usually much darker than natural, is fissured, grooved, nodulated, or tuberculated, and completely deprived of its normal sensibility. Sores occasionally form upon it, and gradually spreading in diameter and depth, add greatly to the local distress. Sometimes small, hard, shining scabs exist, not unlike those of ichthyosis. The chronic march of the

disease, the remarkable deformity of the affected parts, and the peculiar condition of the skin will always prevent it from being confounded with anasarca, the only lesion which bears any resemblance to it.

The disease, once fully established, may remain completely stationary for years, or even during the remainder of life, or it may go on gradually increasing until the affected parts have acquired a volume and a weight many times beyond the natural state. Even under these circumstances, however, the suffering is chiefly of a mechanical character; the general health often continuing good to the last. It is only, in fact, when intractable ulcers form, and there is an abundant discharge of pus, that the constitution is likely to give way under the local drain and irritation. The prognosis is of course most unfavorable in those countries where the disease is endemic; in Europe and the United States, where it occurs only as a sporadic affection, very few die of it.

The *treatment* of elephantiasis is, at best, very unsatisfactory, however early it may be commenced, or however perseveringly and judiciously it may be conducted. Regarding it as essentially consisting in an inflammation of the lymphatic vessels, or of these vessels and the veins, the most rational plan of treatment that suggests itself is the antiphlogistic, of which leeching, blistering, and the application of tincture of iodine are among the more important and reliable means. The object, in the first instance, should be to reduce local action, and thereby prevent subversion of structure. Hence the sooner these remedies are applied the more likely shall we be to obtain resolution. As a sorbefacient, there is no article in the whole materia medica that holds out such strong hopes of relief as tincture of iodine, used either pure or variously diluted to suit the exigencies of each particular case. It not only promotes the removal of effused fluids, but produces a powerful revulsive and antiphlogistic action, and should be employed, steadily and persistently, for many months together. The effects of the treatment will be greatly augmented, if, superadded to it, the parts be occasionally scarified, to relieve engorgement, kept at rest in an elevated position, and well bandaged, strapped, or mechanically compressed. Inunction with mild mercurial ointment also sometimes proves beneficial; and, in the earlier stages of the complaint, lotions of acetate of lead, hydrochlorate of ammonia, and of rectified spirits, are worthy of trial, especially when there is much pain, with a tendency to rapid effusion and organization.

Constitutional treatment is not to be disregarded in this disease. It will, in general, greatly assist the action of local remedies if the patient be put under proper restraint in respect to his diet; if he take occasionally a brisk cathartic, and if he be kept pretty constantly under the influence of the saline and antimonial mixture, with a few grains of calomel every night at bedtime, until slight ptyalism is produced. General bleeding might even be advantageously employed at the beginning of the treatment, if there be a robust and plethoric state of the system.

When the malady has attained an extraordinary degree of development, or has gone on for many years progressively increasing,

or has remained stationary for a long time, no treatment of which we have at present any knowledge, not even ligation of the principal arteries of the affected tissues, will be likely effectually to eradicate the disease, or, more properly speaking, enable the parts to resume their primitive condition. All topical and general means are, under such circumstances, absolutely unavailing; and the utmost that can reasonably be expected from cutting off the supply of blood to the part is a diminution of its size, not a complete restoration of it to health. Professor Carnochan deserves great credit for the laudable effort which he has made, in several cases of elephantiasis of the leg, to arrest the morbid growth, and ultimately cause its absorption by ligaturing the femoral artery; but, although his patients, three in number, were, from all accounts, much benefited, it is questionable whether, in any, a complete cure has been effected. In the summer of 1857, I was present at the Philadelphia Hospital, when Dr. Campbell, then surgeon-in-chief, performed an operation of this kind upon a negro, aged about fifty, who had long been afflicted with this complaint in one of his legs; but the result was not at all encouraging. I saw the man occasionally afterwards for many months, and during my last visit to him, more than a year after the operation, the limb had not undergone any material change, either in volume or consistence. Indeed, such a procedure could hardly be expected to eventuate favorably, when we take into consideration the excessive disorganization of the parts and the astonishing enlargement of the branches of the femoral artery. The operation might, if performed early in the disease, and if conjoined with the use of sorbefacients and the bandage, be worthy of further trial; but I should certainly not feel inclined to recommend its indiscriminate employment.

When the diseased mass is very large, greatly incommoding by its weight and bulk, and entirely unamenable to treatment, the only resource is removal with the knife. If it occupy a limb, amputation will be both a safe and a facile procedure, but if it involve the scrotum, penis, or pudendum, excision may prove not only extremely difficult, but exceedingly perilous, life being endangered, in the first instance, by shock and hemorrhage, and afterwards by pyemia and exhausting suppuration.

6. KELOID TUMORS.

The keloid tumor, so called from its fancied resemblance to a crab, is an affection of the skin, first accurately described by Alibert, in his treatise on cutaneous diseases, published in 1810. It is characterized by the existence of hard, semi-elastic, prominent excrescences, of a cylindrical or rounded form, more or less discolored, and the seat of an unpleasant, itching sensation. Processes, roots, or branches usually extend from it into the neighboring parts, the whole looking very much like the cicatrice of a burn.

The disease is generally described as being extremely infrequent; but judging from my own experience I am far from thinking that this is the fact. I have notes of at least thirty cases, and many more have

come under my observation of which I have neglected to keep any record. It occurs in both sexes, in nearly all parts of the body, and at almost all periods of life. The youngest case of it that has ever been under my charge was in a little girl three years and a half old; on the other hand, I have repeatedly seen it after the age of sixty. A number of the instances that have fallen under my notice happened among negroes; but whether they are more subject to the disease than whites I am not prepared to affirm, although I think it highly probable that they are. I have seen the affection in different classes of society, in different temperaments, and in different occupations; so that I am unable to say what influence, if any, these various circumstances may exert upon its production.

The exciting *causes* of keloid are not always the same. In some cases, though these constitute a marked minority, it arises spontaneously, and is then very liable to show itself in various parts of the body, as if the individual was laboring under a real keloid diathesis. Of this form of the affection I have seen two remarkable examples. In general, keloid succeeds to some local injury; sometimes of a severe, but more commonly of a trivial character, as, for instance, a scratch, puncture, or abrasion. In four of my cases it supervened, respectively, upon the operation of cupping, the application of a blister, the contact of nitric acid, and the cicatrices left by smallpox. In another instance it broke out upon a vaccine scar. In a young lady of seventeen, it was produced by the application of caustic potassa, employed for destroying an enlarged lymphatic ganglion of the neck. In several cases I have known it to follow the use of the knife in the extirpation of tumors. Thus, in an elderly lady from whom I removed the right mammary gland, two years and a half ago, two well-marked keloid growths came on soon after the operation at the site of two small incisions made to ease one of the flaps with a view to more accurate approximation; and the occurrence of the disease after the ablation of keloid tumors both at the line of union of the edges of the wound, and at the parts transfixed by the pins used in introducing the twisted suture, is familiar to every one who has seen much of this affection. But the most common causes of keloid, so far as my observation and reading extend, are burns and scalds; the great majority of the cases that have come under my notice having been produced in this way.

The period which intervenes between the occurrence of the exciting cause and the actual development of the disease is altogether uncertain; in many cases it is quite short, not exceeding a few weeks, or, at farthest, a few months; on the other hand, however, the time is occasionally much longer. In several of my cases, the tumors had acquired a large bulk in the space of a single year. Once fairly commenced, the disease generally proceeds with marked rapidity, especially when it is the result of some traumatic cause; the same is also true, at least in some instances, when it arises spontaneously. Thus, in an instance, recently under my observation, an immense number of these excrescences appeared spontaneously upon different parts of the body within a few months after the first manifestation of the morbid action.

The peculiar *external characters* of keloid will be readily understood

from the annexed drawing (fig. 152), taken from a colored man upwards of fifty years of age, whose body was literally covered with morbid growths of this kind. They were particularly numerous on the neck and trunk, both in front and behind, and also on the shoulders and

Fig. 152.



arms; while the forearms, hands, and lower extremities were entirely exempt from them. In size they ranged from that of a small Lima bean up to that of a sausage, from six to eight inches in length. They were of all shapes; some round or cylindrical, some elongated and flattened, some angular, some crucial, some crab-like, or full of processes, roots or prongs; in short, nature seemed to have exhausted her ingenuity in devising figures for their representation. The surface of nearly all was rough, wrinkled, or puckered. Most of them projected from a line and a half to an inch and a quarter above the surrounding level; some were isolated, others ran into each other, thereby adding still farther to their grotesque appearance. Their consistence varied; most of them were remarkably hard and firm, feeling very much like a mass of fibro-cartilage, with a slight degree of the elasticity inherent in that tissue. In regard to their color, some resembled the natural skin, but the great majority of them were several shades lighter. The intervening integument was sound up to the very borders of the keloid tumors, which were all distinctly circumscribed, and slightly movable, allowing themselves to be raised up with the thumb and index finger; only a few seemed to be completely tied down.

This remarkable case had commenced early in life, but had for years past been almost stationary. The man was well conditioned when I saw him, and his general health had all along been excellent; the only annoyance which he experienced was an itching or stinging sensation in some of the tumors, which, although at times very severe, especially when he labored under constipation, or accidental overheating of the body, left him sufficient comfort for sleep and other enjoyment.

Through the kindness of Dr. Hazard, of this city, I had an opportunity, last summer, of seeing another very interesting case of spontaneous, universal keloid disease, in the person of a young gentleman, aged 18 years, a native of Cuba. Up to twelve months previously, when it first began to show itself, he had always enjoyed excellent health, and, so far as he knew, he was perfectly free from hereditary taint of every description. The tumors were, for the most part, of a rounded or oval shape, not very hard to the touch, movable, vascular, and of a dusky reddish hue. In a few places they existed as distinct ridges, from a line to an inch in width, projecting prominently beyond the level of the surrounding surface. The hands and feet were covered with them, particularly the joints of the fingers and toes; they were also found on the legs, knees, buttocks, right arm, and elbow. They were free from pain, and quite tolerant of manipulation. The general health was somewhat impaired, the youth looking dyspeptic, and laboring under partial paralysis of the left superior extremity.

In white persons the keloid tumor is generally a few shades redder than the adjoining skin; occasionally, indeed, it has a very fiery appearance, and is pervaded by numerous, delicate, superficial vessels, in a state of habitual congestion.

The *site* of the keloid tumor presents nothing of a definite character. When traumatic, it may occur in any part of the body, and the same thing, as we have already seen, may happen in the idiopathic form. It is generally supposed that it is particularly prone to appear on the chest, but, judging from my own observation, I should be inclined to doubt it.

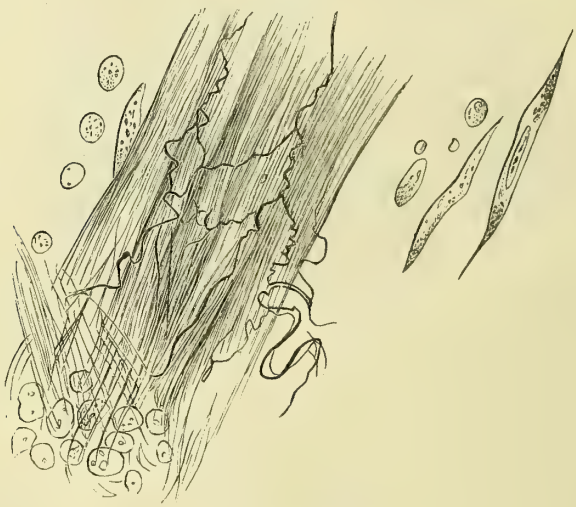
Pathologists have made a distinction between keloid tumors by separating them into two varieties, the true and the spurious. The former, it is alleged, arise spontaneously, whereas the latter are always caused by some local injury, such as that already referred to. From my knowledge, however, of this disease, I am satisfied that such a division is altogether arbitrary, and, consequently, without any foundation in nature; the structure in both of the so-called varieties being perfectly identical.

Keloid, although a troublesome, is not a *dangerous* disease, inasmuch as it never degenerates into malignancy. Of all the cases that have come under my notice, not one has exhibited such a tendency. When excised, however, it nearly always returns, and that in a very short time, rising with increased activity, like a phœnix from its ashes; so that the second state is literally much worse than the first. In some cases, the tumors remain completely stationary for a long time; in others, on the contrary, they gradually advance until they have acquired a considerable bulk, when they usually become passive, and so

continue for many years. Occasionally, in consequence apparently of prolonged pressure or local irritation, they take on ulcerative action, but such an occurrence is, according to my observation, very unusual.

In regard to their *structure*, keloid formations belong to the class of fibro-plastic growths, described in the chapter on tumors. The fibres intersect each other in every possible direction, intercepting cells or spaces occupied by plastic matter, of a softer nature. A section presents, to the naked eye, a whitish, homogeneous aspect, or, if the mass be very old, very much the appearance of an unripe pear or turnip. It creaks slightly under the knife, and is of a dense, firm consistence, with very little elasticity. Hardly any vessels are perceptible in its interior, but the surface of the growth is usually, as already stated, quite vascular, the vessels passing over it in distinct lines, more or less tortuous, and varicose in their arrangement. The minute structure of keloid is well seen in the adjoining sketch (fig. 153), drawn from one of my specimens by Dr. DaCosta.

Fig. 153.



Microscopical characters of keloid.

The *treatment* of keloid is altogether unsatisfactory. So far as I know, there is no remedy which exercises the slightest influence in arresting its progress, or promoting its removal. Sorbefacients and alterants of every description, in every form of combination, and in every variety of dose, have been employed, and yet I am not aware of a solitary instance in which their exhibition, however protracted, has been followed by a cure, or even by a tendency towards such a result. The different preparations of iodine, arsenic, chloride of barium, hydrochlorate of ammonia, and other kindred articles, so serviceable in some other morbid growths, have all signally failed in effecting any beneficial changes in this. The excessive itching, burning, or stinging,

which is a source of such annoyance when the tumors are large or numerous, is best relieved, according to my experience, by a proper regulation of the diet, an occasional active purgative, the exhibition of the antimonial and saline mixture with Fowler's solution of arsenic, and the frequent use of the tepid bath, either simple, or medicated with soda, potassa, common salt, or bran. Anointing the tumors occasionally with oil, or mild pomatum, will also prove serviceable. Everything like pressure or local irritation must be carefully guarded against. If ulceration arise, none but the most soothing remedies should be employed.

As to *excision*, my experience is decidedly opposed to it. In the many cases in which I have tried it, signal failure has been the result, the disease always returning at the site of the cicatrice within a short time after. It is only when the tumors act obstructingly, as when they impede the opening of a natural outlet, or become a source of great disfigurement, that interference should be considered as warrantable. In some cases relief might possibly be afforded by a plastic operation, but on this point I am not able to say anything from personal experience.

7. EILOID.

The eiloid tumor is extremely uncommon, only a few cases having hitherto been met with. It was first described by Dr. John C. Warren, who gave it the present name in consideration of its peculiar coil-like disposition. In its earlier stages it presents the appearance of a small elevation, similar to that occasioned by a burn, which goes on gradually increasing, without pain, heat, redness, or ulceration, until it acquires a large bulk, and sensibly affects the general health. The rolls, in the case of the Boston surgeon, lay in close contact with each other, each being about four inches in length, the whole together looking very much like a triple coil of inflated intestine. The growth seemed to have begun on the right side of the neck by a narrow base. The patient was a negress, about fifteen years of age, whose health had not been good for some time past. The tumor, although removed along with a portion of sound skin, soon returned. When the girl was seen eighteen months afterwards, it occupied the same site, but was not as large as the original one. Being again extirpated, it rapidly reappeared, and soon proved fatal, the patient dying dropsical. Dissection of the body revealed important disease of the liver, water in the splanchnic cavities, and great enlargement of the lymphatic ganglions of the abdomen.

Of the anatomy of eiloid nothing is known. It probably takes its rise in the substance of the dermis, but how, or in what particular part, has not been determined. It is to be regretted that Dr. Warren has failed to inform us whether the secondary growth had the same coil-like appearance as the primary one. The only remedy, of course, for this disease, is early and efficient extirpation, with proper attention afterwards to the general health.

8. LEPOID.

The lepoid formation is most generally observed upon the face, nose, and forehead of elderly persons, usually males, of a delicate florid complexion, with a habitual tendency to congestion of the capillary vessels, light eyes, and light, brown, or reddish hair. Although occasionally single, I have more commonly found it to be multiple. In some instances, indeed, quite a number of lepoid spots are observed, scattered about in different directions, with intermediate healthy skin. It generally makes its appearance in the form of a small, circumscribed speck, not larger, perhaps, than a mustard seed, and of a dirty, grayish color, which becomes covered with a very rough, brownish crust, or scale, resembling the bark of a tree, whence its name. This, falling off, is soon succeeded by another, of the same complexion, form, and consistence. Thus the disease is often kept up for many successive years. At last, however, ulceration sets in, and the dermis exhibits a red, glossy surface, spicular, pitted, or granular, and throwing out a thin, ill-elaborated pus. The skin, upon inspection, is found to be almost of a gristly hardness, its internal surface being studded with numerous little, whitish, rounded bodies, connected together by a dense, grayish substance. The progress of the disease is attended with hardly any pain; but the patient is generally very much annoyed by itching, leading to an irresistible desire to scratch, which always aggravates it.

The nature of lepoid is undetermined. Without being able to speak positively, I am strongly inclined to believe that it is merely a variety of lupus, or epithelioma; a supposition deriving plausibility from the circumstance that, although generally disposed to remain long stationary, or to make but little progress, it often ultimately takes on malignant action; pursuing then very much the same course as the milder forms of lupus.

The best remedy for this disease is non-interference. The rough, bark-like scale may occasionally be softened with a little very dilute citrine ointment, or covered with a mixture of two parts of collodion and one of castor oil, to serve as a defence from the air. All irritating applications must be refrained from. If the disease is inclined to spread, the tissues may be destroyed with the Vienna paste, or removed with the knife; but in general it will be safest to eschew all operative interference, as likely to aggravate the case by an early recurrence of the formation, and its more rapid tendency to malignancy.

9. LUPUS.

Under the term lupus are comprehended two varieties of disease, the chief peculiarity of which is a tendency to destructive ulceration of the skin and areolar tissue, or of these and the more deep-seated structures. In point of fact the two affections are identical, the only difference between them being that the one is milder than the other, more tardy in its progress, and less disposed to spread, its ravages being generally limited to the cutaneous textures, or to the parts in which it is originally located. The former of these affections is called

the non-exedent, stationary, or serpiginous ulcer; the latter the exedent, eating, or corroding ulcer. It is also known as the cancroid or voracious ulcer. The older surgeons described it under the appellation of *noli me tangere*, in reference to the exquisite sensibility by which it is so often characterized. The term lupus, signifying wolf, is suggestive of the destructive tendency of the affection.

Of the *causes* of lupus, in both of its forms, we have no definite knowledge. In general, it comes on spontaneously, or without any assignable reason, and soon exhibits its peculiar features. Occasionally its origin is apparently referable to some local injury, as a scratch, abrasion, or contusion, or to the irritation of some warty growth. It is commonly supposed that a scrofulous state of the constitution predisposes to its occurrence, and this is probably true, although in a much less degree than has been imagined. My own experience certainly does not warrant the conclusion that the origin of the disease has, in general, any such relation; in most of the cases that have come under my observation, the patients seemed to be peculiarly free from strumous taint, both as it respected the actual state of their own system, and everything like hereditary transmission. Persons of a delicate, ruddy complexion, with light hair, blue eyes, and an unusually active capillary circulation, are most prone to the disease, not only as it regards its frequency, but also the rapidity of its progress and the extent of its ravages. How far a syphilitic taint of the constitution may act as a predisposing cause of lupus is a point that has not been ascertained; unfortunately, it is seldom in the power of the practitioner to obtain a sufficiently accurate account of his cases to enable him to trace, in a satisfactory manner, their various relations.

Lupus may occur in any part of the body, but it will most commonly be found to manifest a peculiar predilection for the nose, cheeks, and eyelids, especially the lower. It is observed in both sexes, and rarely shows itself until after the age of forty. When it attacks the face, it sometimes breaks out simultaneously, or nearly so, at several points. The ulcers, in both varieties of the affection, are usually of an intractable nature, or if, as occasionally happens, they heal at one place, they are sure to spread at another. Their secretions are of an ichorous nature, and their surface is covered by a brownish, characteristic scab. If reparation take place, the new skin is always very hard, white, irregular, and prone to take on disease from the slightest causes.

1. The *non exedent lupus*, often described as the serpiginous ulcer of the face, generally begins either as a small, hard, white, shining tubercle, or as a fissure, crack, or excoriation, with indurated edges, and a thin, brownish incrustation. In either case, it soon exhibits its characteristic tendency to spread, not in depth, but circumferentially, for it rarely, at least in its earlier stages, penetrates beyond the substance of the true skin, or even far into it. In fact, it is essentially a superficial ulcer, passing generally from one point to another, but seldom involving the deeper structures, except, perhaps, when it appears on the ala of the nose, where it occasionally evinces a highly erosive disposition. When it affects the eyelids, it may, in time, extend to the fibres of the orbicular muscle, and even to the tarsal car-

tilage, but in general it remains limited for years to the skin, or skin and areolar tissue. The parts around the ulcer are hard, puckered, tender, and usually somewhat reddish, although very often they retain their normal color. The ulcer is the seat of occasional darting, stinging, or shooting pain, and of more or less itching, generally much more disagreeable than the pain itself. When the scab, which is usually very thin, and of a brownish, or blackish color, drops off, it is speedily succeeded by another of a similar kind. When the surface is thus exposed, it is occasionally found to be covered by very red, vascular, sensitive granulations, smeared over with thick, yellowish, viscid pus, and disposed to bleed on the slightest touch. The edges of the ulcer are usually steep, jagged, and slightly everted. As the sore spreads in one direction, it often heals in another, leaving a whitish, leucoid, or milky scar, strikingly contrasting with the surrounding parts.

The non-exedent form of lupus is said to be most common in young scrofulous females, but if this be the fact, my experience has failed to afford me any evidence of it. In most of the cases that have fallen under my observation, and they have been very numerous, it appeared after middle life, in both sexes, with a complexion that was either very florid at the time, or had been so shortly before the attack. My opinion is that writers often confound this affection with the effects of a syphilitic taint of the system, exhibiting itself in the form of one or more superficial, foul, obstinate ulcers, which, when their nature is properly understood, may always be made to disappear promptly under the use of iodide of potassium and bichloride of mercury.

In the *treatment* of this variety of lupus, none but the mildest and most soothing applications should be employed. The one from which I have derived most benefit is the dilute tincture of iodine, which, while it changes the action of the secernent vessels, promotes the removal of effused fluids, and serves as a protective against atmospheric and other injurious impressions. As long as the scab remains on the surface of the ulcer, it should not be disturbed; otherwise it may be covered with a piece of lint, spread with a small quantity of the ointment of the nitrate of mercury, largely diluted with simple cerate. Occasionally a little powdered opium forms a valuable addition. Brushing over the part once every three or four days with a mixture of collodion and glycerine often answers a good purpose. When the ulcer is foul, and has a disposition to spread, it should be touched once or twice, lightly but effectually, with the dilute acid nitrate of mercury. All severe applications must be avoided, as they generally do immense harm.

Along with these topical remedies, special attention must be paid to the state of the general health, which is often not a little disordered. The diet should be light, simple, unirritant, and chiefly, if not exclusively, of a vegetable character, the drinks consisting of water, milk, or weak tea; the bowels and secretions should be regulated with blue mass and ipecacuanha, or blue mass and colocynth; and if signs of debility exist, as denoted by the state of the countenance, pulse, and

strength, tonics should be resorted to, in combination with alterants, of which the best are quinine and iodide of iron, in combination with a minute quantity of bichloride of mercury and arsenious acid. Of late, very favorable mention has been made of the use of the chloride of arsenic in the treatment of this affection, in doses varying from eight to fifteen drops thrice a day, and a number of cases illustrative of its beneficial effects have appeared in the medical journals. Of its efficacy, however, I can say nothing from personal experience. When the vital forces are much impaired, cod-liver oil and milk punch must be pressed into the service.

2. The other variety of lupus, the *exedent*, corroding, or devouring lupus of authors, belongs unmistakably to the class of affections described by modern pathologists under the name of epithelioma, or cancroid disease. It is a genuine cancerous development, generally beginning in the form of a hard tubercle, crack, or warty excrescence, and rapidly extending in different directions, both in circumference and depth, until it has occasioned the most frightful ravages, and the most dreadful and disgusting deformity. Thus, it often consumes the whole of the nose, one cheek, the entire lip, the chin, or perhaps the orbit of the eye, and the forehead, the ball of the eye being completely severed from its connections and dropping down into the frightful chasm below. To witness some of these cases is a truly pitiful and shocking sight. The progress of the disease is often remarkably rapid, great mischief being sometimes done in a few months; at other times its march is more slow, or the malady, after having evinced a most destructive tendency, may suddenly stop, with all the appearances of a complete cessation of hostilities. A case has been reported to me where the morbid action, after having destroyed the greater portion of one cheek with the corresponding antrum, has remained in a state of abeyance for the last eight years, although it had been steadily pursuing its course for upwards of fifteen.

The ulcer in this variety of lupus has an excavated appearance, as if it had been punched out of the parts on which it rests; its edges, however, are generally somewhat everted, or everted at one place, and slightly overhanging at another, ragged, and often as if worm-eaten; the bottom is foul and covered with unhealthy granulations, or granulations and aplastic lymph; the discharge is ichorous and irritating; and the surface around is indurated, tender, and more or less discolored and œdematous. The pain is generally severe, being of a sharp, biting, darting, or shooting character, and liable to temporary exacerbations from exposure, irregularities of diet, and atmospheric vicissitudes. The general health, at first perhaps entirely sound, becomes seriously affected during the progress of the disease; the appetite and sleep are impaired; the strength declines; marasmus gradually ensues; and the patient, worn out by suffering, finally dies completely exhausted.

The great object in the *treatment* of the corroding form of lupus is to arrest the morbid action, either with the knife, or some suitable escharotic, as the acid nitrate of mercury, or the Vienna paste. In regard to the first of these measures, I must confess I have no great

confidence in its efficacy as a means of preventing a recurrence of the disease, since it does not appear to be capable of exerting upon the capillaries in the neighborhood of the affected parts that alterant influence which is necessary to cause a permanent suspension of the specific action upon which the malady originally depended. In most of the cases in which I have employed the knife, the result has been anything but flattering, notwithstanding the most thorough excision and the most careful attention in regard to the after-treatment. Indeed, I have often been struck with the apparent avidity, so to speak, with which the disease returns. My opinion, therefore, is that excision, as a general rule, should give way to escharotics, either such as have been just alluded to, or, what, I believe, is preferable, in nearly all cases, the actual cautery. The hot iron not only effectually destroys the diseased tissues, but it seems to create a wide spread salutary influence among the surrounding parts, eminently unfavorable to repullulation. Notwithstanding, however, all the care and precaution that can be employed both to get rid of the disease and to oppose its return, it must be confessed that our efforts are generally, in the end, unavailing, the malady usually coming back, and ultimately terminating fatally.

As long as the disease is stationary, it will be best, as a general rule, not to interfere with it in any manner; the scab, if there be any, should be let alone, or if the surface be exposed, it should be treated with the most soothing and gentle means.

The general health must, in this as in the more simple variety, receive, throughout, proper attention; alterants and tonics will often afford essential service; and the strictest vigilance should be exercised in regard to the diet, bowels, and secretions. Arsenic, bichloride of mercury, and iodide of iron are particularly deserving of trial as constitutional remedies.

10. MELANOSIS.

Melanosis of the skin is very uncommon, and probably never occurs as a primary disease, being apparently always propagated from the subcutaneous cellular substance, or from some lymphatic ganglion. It nearly always co-exists with melanosis in other parts of the body, and is, therefore, merely an evidence of a general taint of the system. In a case that was under my observation, some years ago, in a man, aged fifty-eight, it involved nearly all the principal organs, and of course finally proved fatal. In another instance which occurred in this city, while I was a pupil of the late Dr. George McClellan, an immense number of melanotic tumors existed in the skin and cellular tissue of the abdomen, varying from the volume of a small pea up to that of a mass the size of a large almond; they were of a firm, fibro-cartilaginous consistence, slightly movable, exquisitely painful, and of a bluish-black color. The remedy, in this case, was excision, a few of the larger tumors being removed at a time; the operation was repeated every ten or twelve days, for several months, by which time, but little progress being made towards a cure, the patient became tired, and

positively declined further interference. He finally died completely exhausted by his disease.

When melanosis is confined to the integuments, and occurs as a circumscribed tumor, the proper remedy is early and free excision; but under opposite circumstances, or, when it co-exists in other parts, or is extensively diffused through the cutaneous and areolar tissues, all interference of the kind should be avoided, as likely to accelerate the fatal crisis.

11. SCIRRHUS.

Scirrhus of the cutaneous tissue is also exceedingly uncommon; it is, however, occasionally met with in various parts of the body, particularly the face, forearms, and hands. It generally begins in the form of a whitish, milky, or leucoid spot, commonly a little elevated above the surrounding level, but now and then apparently somewhat depressed, of a dense, firm consistence, more or less rough, and completely inlaid in the substance of the skin. Large vessels frequently extend across the affected parts, the redness contrasting strikingly with the whiteness of the intervening surface. Movable at first, the tumor gradually contracts adhesions, and, in time, involves the subcutaneous cellular substance. If a section be made, it will be found to be traversed by white lines, and to yield, on pressure, a small quantity of lactescent fluid.

Although the progress of this affection is usually slow, its tendency is ultimately to disintegration and decay, the resulting ulcer having an irregular, jagged appearance, with everted edges, and a foul bottom, the discharge being of a sanious, or ichorous nature. More or less pain, of a sharp, lancinating character, generally attends. As the morbid action proceeds, new leucoid spots are often superadded to those already existing; the health gradually gives way; and the patient finally dies exhausted, though commonly not until carcinomatous disease has developed itself in some of the internal organs, particularly the lungs, pleura, and liver. Occasionally the affected parts assume a true encephaloid character, and in this way a considerable-sized tumor may ultimately be formed, very tender, vascular, and subject to frequent hemorrhages. Finally, the scirrhous matter sometimes exists as an infiltration, although such an occurrence is very infrequent.

Secondary scirrhus of the integuments is by no means uncommon; it is most frequently seen in carcinoma of the mammary gland and lymphatic ganglions, and generally presents itself in the form of small, hard, shot-like tubercles, firmly and immovably fixed in the substance of the skin. The number of these little bodies is sometimes very great; they are usually quite painful, seldom attain much bulk, and do not often ulcerate, the patient nearly always dying of the primary disease before this event has had time to take place.

The ultimate character of these secondary formations is not well understood; in most cases, especially when of long standing, and of large size, they contain encephaloid matter and true cancer juice. Melanotic substance is sometimes interspersed through them.

Scirrhus of the integuments presents the same unrelenting character as this disease in other parts of the body; extirpation, the only resource in the early stage of the malady, holds out no prospect of permanent relief, and hence all that can generally be done is to palliate the patient's suffering.

SECT. VIII.—INSECTS IN THE SKIN AND CELLULAR TISSUE.

The skin and cellular tissue are liable to be infested by certain insects, which, although not poisonous, are capaple of inducing serious suffering, especially in persons of a nervous, irritable temperament. I refer more particularly to the chigoe and the Guinea worm.

The *chigoe*, which is very common both in this country, South America, and the West Indies, is a little insect, scarcely half the size of the smallest pin head, which penetrates the skin of the hands and feet, as well as of other exposed parts of the body, for the purpose of sustenance and hatching. It is a species of flea, with a rostrum as long as the body, of a pale-brownish, semi-transparent appearance, with legs of a light lead color, which often deposits its eggs in immense numbers. The first effect is an itching sensation, which is soon followed by heat, redness, and swelling, and ultimately by an ugly, irritable, spreading ulcer. If the part, when it has attained this stage, be carefully examined, it will be found to contain a cyst, about the size of a pea, and of a bluish color, in which the ova live and multiply with astonishing rapidity. When a number of chigoes penetrate the skin together, the suffering produced by them may be so great as to cause violent constitutional disturbance and even death.

The *treatment* consists in picking out the insect and its eggs with a fine needle, care being taken not to rupture the cyst, otherwise the young brood may produce further mischief. Clearance having been effected, the part is well washed with salt water, tobacco juice, or spirits of turpentine, and thoroughly painted with dilute tincture of iodine. The female slaves in the West Indies are said to extract these insects with great dexterity.

The Guinea worm, or little dragon, technically called *filaria medinensis*, also buries itself in the body. It is chiefly met with in hot countries, particularly in Egypt, Arabia, Persia, Abyssinia, and Guinea, the inhabitants of which are often sorely afflicted by it. Of a white color, and of a filiform shape, it has an orbicular mouth, and a slightly pointed tail, its usual length being from five to ten inches, and its thickness that of a small violin string. Its ordinary abode is the subcutaneous cellular tissue of the feet and legs, though it is also found in other parts of the body, as the face, neck, scrotum, hands and arms. It is commonly coiled up circularly, and is inclosed by a distinct cyst, which thus separates it from the surrounding parts. The animal enters the skin when quite young, and gradually increases in size, exciting intolerable itching, inflammation, swelling and suppuration, often attended with fever, and sometimes followed by gangrene. The precise situation of the worm is generally indicated by a sort of

boil, or a hard, ridge-like elevation. When ulceration sets in, the head of the creature usually protrudes at the opening, thus confirming the diagnosis of the case.

In the *treatment* of this affection, the proper plan is not to allow the patient to be tormented by the employment of inefficient remedies, but to cut down at once upon the part, and extract the intruder. It is worse than useless to waste time in the application of leeches, liniments, and embrocations, which, so long as the cause of irritation lies buried under the skin, can produce none but the most transient effect. If the tumor is already open, and the head of the animal is protruding, extrusion may be promoted by gentle tractions.

SECT. IX.—WARTS, OR VERRUCOUS GROWTHS.

Warts are those peculiar excrescences, or prominences, so often seen upon the hands and face of young persons, although the old are by no means exempt from them. They consist essentially of a hypertrophous condition of the papillary structure of the skin, and sometimes occur in such numbers as to constitute a genuine verrucous diathesis. When this is the case, they are not only developed with remarkable rapidity, but are apt to attain an extraordinary size. Of the exciting causes of warts, nothing is known; they often occur in several members of the same family, and instances are observed in which they betray a hereditary tendency.

A wart is a hard, insensible excrescence, generally of a conical shape, more or less movable, and attached by a broad base, although sometimes the reverse is the case, the union being effected by a very narrow pedicle; its surface is rough, fissured, or tuberculated, and usually a few shades darker than the adjacent skin; its size seldom exceeds that of a common pea. When cut, it is painful, and bleeds somewhat. Its structure is essentially cellulo-fibrous. The fluid which follows a section of a body of this kind, has been supposed, but erroneously, to be contagious, or inoculable. A wart on the face, arm, or shoulder sometimes becomes the seat of carcinoma, especially when it is constantly rubbed or irritated.

The *treatment* of warts is very simple. In young persons, in fact, they often disappear spontaneously. The best local remedy is chromic acid, with equal parts of water, applied with a glass brush. It instantly turns the skin black, and forms an eschar, which drops off in six or eight days, leaving a healthy, granulating sore, which soon heals. Tincture of iodine, acetic acid, bichloride of mercury, and sulphate of copper, also, answer an excellent purpose. When a verrucous diathesis exists, recourse must be had to the exhibition of arsenic, or Donovan's solution. Excision is necessary when a wart displays a tendency to malignancy.

CHAPTER II.

DISEASES AND INJURIES OF THE MUSCLES, TENDONS, BURSES, AND APONEUROSES.

SECT. I.—MUSCLES.

The muscles are liable to wounds and lacerations, inflammation, atrophy, hypertrophy, and different kinds of transformations, especially the fatty, which occasionally exists in a very high degree, and over a considerable extent of the body. They are also subject to some of the carcinomatous formations, and to the development of hydatids and serous cysts.

1. *Wounds.*—When a muscle is divided by a sharp instrument, or accidentally ruptured, its fibres immediately retract so as to drag the edges of the wound more or less widely asunder. The extent to which this separation may be carried varies, in general, according to the length and thickness of the muscle, from a few lines to as many inches. In transverse fractures of the patella, the action of the straight muscle of the thigh often draws the superior fragment from three and a half to four inches away from the inferior; and it is reasonable to conclude that fully as extensive a gap would be produced between the ends of this muscle if it were cut in two, or torn asunder. In rupture of the straight muscle of the abdomen, the edges of the subcutaneous wound have repeatedly been found to be separated from an inch and a half to two inches. In the operation for the cure of strabismus, the retraction of the posterior extremity of the divided muscle is seldom less than from four to six lines, and often even considerably more.

The above facts are highly interesting in a practical point of view, inasmuch as they point out the propriety of adopting prompt and energetic measures for effecting and maintaining apposition of the ends of the divided muscle; for observation has shown that the more accurate this is the more speedy and perfect will be the cure. If the edges are brought fully and intimately together, the union will necessarily require but a small quantity of plastic matter for its early and complete consolidation. If, on the other hand, the gap amounts to several inches, either no union will occur, or it will be effected through the intervention of a large quantity of cellulo-fibrous tissue, possessing none of the properties of muscular fibre. Hence the affected structures must always remain proportionably weak and disabled. But this is not the only inconvenience that follows such an accident; in wounds of the abdominal muscles, for example, the gap is sure to give

rise to hernia, and it is easy to see that a deficiency of this kind elsewhere would hardly be productive of less serious effects.

2. *Laceration.*—Rupture of the muscles is often produced by very trifling causes, the most common of which are leaping, or jumping across ditches or over fences, lifting heavy weights, or falls from a considerable height, in which the person makes a powerful effort to ward off injury. Cases are upon record of women having lacerated the abdominal muscles during parturition. Injuries of this kind are most likely to happen, other things being equal, when a muscle has undergone the fatty degeneration, which, by rendering its fibres soft and lacerable, acts as a powerful predisposing cause of rupture. Long continued inactivity of a muscle followed by sudden and violent contraction, may be mentioned as another predisposing cause of the accident.

The muscles which are most liable to rupture are the straight muscles of the abdomen, the psoas, deltoid, the two-headed flexor of the arm, the straight femoral, and gastrocnemius.

The place where the rupture usually occurs is near the junction of the fleshy fibres with their tendons; but occasionally a muscle may give way at its middle, or, in fact, at almost any portion of its extent. In twenty-one cases of this affection analyzed by Sédillot, the rupture, in thirteen, took place at the insertion of the fleshy fibres into their tendons, while in the remainder the lesion was seated in the body of the muscle itself. The laceration is sometimes limited to a few fibres; at other times it involves the entire thickness of a muscle, or of a muscle and its aponeurotic envelop. Finally, cases occur in which a number of muscles are ruptured.

The *symptoms* attendant upon this lesion are not always well marked, especially when the affected muscle is deep seated. In general, it may be assumed that the accident has occurred, if, at the moment of some violent bodily exertion, as in leaping a ditch or fence, the individual has heard a distinct noise or snap, like the crack of a whip, feels severe pain in some particular spot, and either falls down, or has but an imperfect use of himself. Upon examining the suffering part, a vacuity will probably be noticed at one point, and an unusual prominence at another, followed by more or less discoloration and tenderness under manipulation. Occasionally the accident is attended with a rather copious hemorrhage, caused by the rupture of a considerable-sized artery, as, for instance, the epigastric in laceration of the straight muscle of the abdomen. The pain which follows the injury is often very sharp, and rarely entirely disappears until after the primary effects of the lesion have measurably passed off.

Temporary lameness and inability to move about for some time, are, in general, the most serious consequences to be apprehended from this accident, provided it is properly managed immediately after its occurrence. In most cases, a considerable period must necessarily elapse before the reunion of the torn structures will be sufficiently firm to justify their accustomed use. Occasionally violent symptoms have supervened upon the accident; and an instance has been reported of a young man who died from rupture of the psoas muscle, death having been preceded by severe inflammation and infiltration of pus.

The *treatment* of this lesion cannot be the same in all cases, or under all circumstances. Whenever it is practicable, from the superficial situation of the affected muscle, its ends, whether they have been cut or ruptured, should be freely exposed, and then carefully approximated by a sufficient number of stitches to hold them in contact until firm union has been established. For this purpose the threads should be carried nearly through the entire thickness of the muscle, the object being thorough apposition both of the superficial and deep portions of the wound. In case the muscle has been ruptured, the edges of the wound may be so ragged as to require some retrenching before placing them in contact, just as in a lacerated wound of the integuments. If the precaution of stitching the parts be neglected, the results above adverted to will be inevitable, and it is, therefore, impossible to insist too strongly upon the importance of attention to this rule, which is so much neglected by surgeons.

The parts being properly approximated, are next placed in an easy, elevated, and relaxed position, splints and bandages being employed for this purpose, if necessary; they are then treated upon general antiphlogistic principles. If the ruptured muscle be deep-seated, our chief reliance must be upon rest and relaxation, aided by soothing and astringent applications, along with suitable internal remedies, to moderate the resulting inflammation. In lacerations of the muscles of the extremities, important advantage may always be obtained from the use of two rollers, applied in opposite directions, as the ends of the wound may thus not only be more effectually approximated, but the contraction of the fleshy fibres more easily controlled, than in any other manner.

3. *Inflammation.*—Inflammation of the muscles may present itself in two varieties of form, the acute and chronic; both, however, are uncommon, and are chiefly observed as consequences of external injury, as blows, wounds, or contusions, such as we meet with in fractures and dislocations; or as effects of gout and rheumatism. The sheaths of the muscles very frequently, if not generally, participate in the morbid action. When the inflammation is at all severe, considerable effusion of serum and lymph may take place, but it is seldom that the disease runs into suppuration, much less mortification. The latter termination is chiefly met with in erysipelas and carbuncle, in old worn-out subjects, and in persons of different descriptions after violent external injury. It is easily recognized by the dark greenish color of the fleshy fibres, by their softness and lacerability, and by their excessively fetid odor. The parts are detached in ragged shreds, bathed in a thin, sanious, dirty, and offensive fluid.

Acute inflammation of the muscles is characterized by excessive pain, of a sharp, darting character, or by dull, heavy, aching sensations, accompanied with a feeling of soreness, and aggravated by the slightest motion and pressure. In some cases, as when the disease supervenes upon fractures or the amputation of a limb, it is attended by a remarkable twitching or jerking, occasionally amounting to real spasm, which only yields to large doses of anodynes, and hot, soothing applications.

Chronic myositis is not uncommon; like the acute variety, to which

it generally succeeds, it is more frequently met with, surgically considered, as a secondary than as a primary affection. When long continued, it is very prone to give rise to fatty degeneration, softening, ulceration, and other changes, which it is often impossible to cure.

4. *Fatty Transformation.*—Fatty degeneration of the muscles is often, if not generally, a result of chronic inflammation, especially when conjoined for any considerable period with steady, persistent inactivity, or want of exercise. Whether inflammation, however, is always necessary to its formation is still a mooted question, although it is highly probable that it is. When thus affected the fleshy fibres assume a pale yellowish, whitish, or slightly reddish color, at the same time that they are unctuous to the touch, and so much softened as to yield under the most trivial force. On pressure, a clear, oily fluid oozes out, which greases the finger, is highly inflammable, and is composed of elain, adipocire, and ordinary fat, in variable proportions. These substances are not deposited, as some have conjectured, between the fleshy fibres, but form actually a portion of their constituent principles; their proper tissue being found, when examined microscopically, to be filled with granules, partly interposed between their striæ, and partly replacing them.

The fatty transformation is most common, as well as most marked, in the muscles of the loins, hip, thigh, and leg of old persons affected with paralysis. It is likewise occasionally observed in the heart, and now and then in the muscles around unreduced luxations, large exostoses, and old, deep-seated ulcers. When the change is profound and extensive, it sometimes involves the corresponding tendons and aponeuroses, which, in consequence, lose their polished, satin-like lustre. So far as we know, this disease does not admit of cure.

5. *Ulceration.*—Ulceration of the muscles is an uncommon occurrence; it is chiefly noticed in phagedenic sores of the leg, extending successively through the integuments, cellular tissue, aponeuroses, and, finally, the muscles, which, however, generally resist its encroachments in a very remarkable degree. In some of these cases the fleshy fibres are in a complete state of fatty degeneration, of a whitish color, and so soft as to admit of being scraped away with the greatest facility. When the ulceration is slight, the restorative process usually proceeds kindly, and the breach is soon filled with healthy granulations. No special treatment is required in this disease, apart from the remedies ordinarily employed under such circumstances.

6. *Contraction.*—Another effect of inflammation of the muscles, or of the muscles and their fibrous envelops, is contraction of their fleshy fibres, leading to marked disorder of their functions, along, perhaps, with severe pain, and even to great deformity, as we so often see in wry neck, consequent upon inflammation of the sterno-cleido-mastoid and splenius muscles, and the muscles of the thigh from the effects of hip-joint disease. In many of these cases the disease is obviously of a gouty or rheumatic character, and, under these circumstances, it often occurs at a very early age, the immediate exciting cause being usually exposure to cold or cold and wet.

In the *treatment* of myositis attended with contraction of the affected

muscles, the first object should be to ascertain, if possible, the nature of the exciting cause; as to whether it is the result of rheumatism, gout, scrofula, or syphilis, or of external injury, as a sprain, twist, blow, wound, or contusion; for upon the knowledge thus derived must necessarily depend the character of our remedies, and the chance or otherwise of a cure. I have usually received marked benefit in these cases from the use of the wine of colchicum in combination with a full dose of morphine at bedtime; aided by active purgatives and diaphoretics, especially the warm bath, a well-regulated diet, and the frequent application of Granville's lotion in union with laudanum and soap liniment, thoroughly rubbed upon the affected muscles. The muscular rigidity attendant upon a syphilitic state of the system is best treated with iodide of potassium, either alone, or conjoined with mercury.

In the more subacute or chronic cases of muscular contraction, great benefit may be expected from the use of the hot and cold douche, employed twice a day, and followed, first by dry friction, then by the application of stimulating liniments, and, finally, thorough shampooing. Frequent motion is also generally of great service; to break up adhesions, and to promote the absorption of effused fluids, upon which the rigidity often mainly depends, as is observed in the shortened and rigid state of the limbs after severe fractures and dislocations.

7. *Atrophy.*—Atrophy of the muscles, of varying degrees, is occasionally observed; it may occur in any of the voluntary muscles, but is most common in those of the shoulder and hip, the deltoid suffering perhaps more frequently than any other individual member. It may depend upon different causes, but generally it is produced by inflammation, palsy, or defective circulation; indeed, whatever has a tendency to impair the function of innervation, retard or diminish the supply of blood, or induce permanent inactivity in a muscle, may be considered as so many causes of the affection. Hence it is found that the lesion is usually associated with paralysis, whether proceeding indirectly from disease of the cerebro-spinal axis, or directly from injury of the nerves distributed to the suffering structures. The muscles around luxated joints, especially those of the hip and shoulder, are frequently atrophied, either simply from the want of use, or, what is more probable, the conjoint influence of inflammation and inactivity. In coxalgia similar effects generally occur, the wasting usually involving all the muscles of the lower extremity. The fact that gout and rheumatism are frequently productive of atrophy of the muscles is familiar to every practitioner.

The extent to which the wasting of the muscles may proceed is variable. When it exists in a high degree, they may be reduced to mere membranous bands, pale, flaccid, and almost devoid of irritability; in some rare instances their fleshy fibres are completely absorbed, a dense cellular substance being all that is left in their place; or, instead of this, they are found to be softened and transformed into fatty matter.

In the *treatment* of atrophy of the muscles the first object should be to ascertain, if possible, the nature of the exciting cause, by removing

which the lesion sometimes rapidly disappears of its own accord; or, at all events, under very simple management. Atrophy dependent upon imperfect supply of blood is often irremediable, and the same is frequently the case when it is caused by gout and rheumatism, or when it is conjoined with the fatty degeneration. The treatment of atrophy dependent upon loss of innervation, constituting what is called wasting palsy, will receive special attention in the chapter on the diseases and injuries of the nerves, where its consideration properly belongs.

Whatever the cause of atrophy of the muscles may be, much may be done, after that cause has been removed, towards effecting restoration by the steady and persistent use of the hot and cold douche, stimulating embrocations, dry frictions, and regular, systematic exercise of the affected structures, educating them, so to speak, and thus gradually qualifying them for the resumption of their appropriate functions.

8. *Tumors.*—Various morbid growths occur in and among the muscles, the principal of which are the hydatic, cystic, melanotic, and encephaloid.

a. It is uncommon to meet with *hydatids* in the muscles; I have myself seen but one case of it. It occurred in 1853, at the surgical clinic of the University of Louisville, in a laboring man, aged twenty-five years, who accidentally discovered a swelling in the substance of the right deltoid muscle six months previously, when it was hardly as large as a hazelnut. At the time of my examination, it was of the volume of an almond with its shell, of a rounded, elongated shape, somewhat movable, and of a firm, fibrous consistence, with a slight degree of elasticity. Within the last few weeks the tumor had become somewhat painful, especially after exercise, and the pressure made in examining it was productive of considerable uneasiness. The skin over it was perfectly healthy. The patient was not aware of anything that could have produced the disease.

The diagnosis of the tumor could not, of course, be determined beforehand; what it resembled most, especially in point of consistence, was an enlarged lymphatic ganglion, but the rarity of such a disease in this situation invalidated this conclusion, and left me in complete doubt as to the true nature of the case. It was too deep-seated for a sebaceous tumor, and it possessed none of the external characters of a fibrous, fibro-plastic, or fatty one.

In performing excision, the knife was carried perpendicularly down over the tumor, in doing which, the point penetrated its interior, an occurrence which was instantly followed by the escape of a small quantity of thin pus, inducing me to think that the tumor, after all, was merely a diseased lymphatic ganglion. On continuing the dissection, however, I soon found that there was a distinct cyst, which, being collapsed, was separated with some difficulty from the fibres of the deltoid muscle, in which it was embedded. The dissection being completed, a small body was picked up on the floor, which, on inspection, proved to be a globular hydatid, not more than six lines in diameter, and furnished with a distinct sucker (fig. 154). The cyst was very soft and thin, smooth internally, and filamentous externally.

Fig. 154.



b. Tumors of a *cystic* character are sometimes met with in and among the muscles. In a case of this kind, which I had an opportunity of seeing in 1856, with Dr. Da Costa, the growth, occupying the upper and outer portion of the thigh, had acquired nearly the volume of an adult head. The patient was a female, aged fifty-eight, and the disease had apparently resulted from a fall down a flight of stairs, in which she struck the limb severely, causing deep ecchymosis and great difficulty in walking. At the end of two months a swelling formed in the situation adverted to, which, gradually increasing, in the course of ten months acquired the size above mentioned, being at the same time the seat of severe darting pains, with considerable discoloration of the integuments. The tumor fluctuated indistinctly, but a puncture with the exploring needle gave vent merely to a few drops of fatty fluid. When removed by Dr. Brinton, it was found to be composed of a very thick, dense, fibrous cyst, filled with a sero-oleaginous fluid. The patient gradually recovered from the effects of the operation, but has been troubled ever since with pain in the limb and difficulty in walking.

c. Melanosis sometimes occurs in the muscles, either as an infiltration, or as a distinct tumor, with or without a cyst, of an irregularly spherical shape, firm in consistence, and from the volume of a pea up to that of a fœtal head. The morbid product, which generally coexists with similar formations in other parts of the body, is occasionally directly chargeable to external injury; but generally it takes place without any assignable cause.

d. Encephaloid, scirrhus, and colloid of the muscles are very uncommon, so much so, that few practitioners ever meet with them. They obey the same law here as when they occur in other parts of the body. In the interesting case of colloid described by Professor J. C. Warren, an immense number of tumors of this kind, varying in size from a pea to that of a small granule, hardly visible without the aid of a microscope, existed in the voluntary muscles, in different regions, especially in those of the thigh and leg.

The probability is that none of these heteroclite formations are developed in the muscular substance, properly so-called, but that they begin in the inter-fibrillar tissue, from which, as they increase in size, they gradually encroach upon the fleshy fibres, which they thus displace, alter, or destroy.

SECT. II.—TENDONS.

The tendons, like the muscles, are liable to wounds and lacerations, but, unlike them, they never suffer from malignant formations, excepting secondarily, and then only very rarely. Inflammation of these structures is also very infrequent.

1. *Wounds.*—Tendons, when divided subcutaneously, readily unite through the intervention of plastic matter, without the occurrence of any considerable degree of inflammation. Indeed, the idea is very

common at the present day that such wounds are always repaired without inflammation, it being alleged that this process, instead of being necessary for this purpose, is a positive detriment. I cannot subscribe to such a doctrine. If its advocates mean that the inflammation is very slight, or not characterized by the ordinary phenomena, I perfectly agree with them; but if they wish to be understood as affirming that inflammation is entirely absent throughout, from the beginning to the close of the case, it is what I cannot believe, and what is certainly not true.

When a tendon, such, for example, as that of the heel, is cut across subcutaneously, the first thing that is noticed is the retraction of the divided ends, so as to leave a distinct gap between them, often amounting to from an inch and a half to two inches, according to the size of the cord and its previous tension, or the degree of force employed in stretching the parts with which it is connected. Inflammation, generally of a very slight form, next takes place, and, soon after this is set up, plastic matter is poured out, filling up the space between the two extremities of the tendon, which, at the same time, it serves to connect together. As the abnormal action subsides, nucleated cells form in the interior of the effused matter, and the process of organization thus begun steadily advancing, the new substance is gradually converted into cellulo-fibrous tissue, and this, in its turn, at length into tendinous, which, however, although well calculated to fulfil the purpose for which it is intended, is, like all new tissues, a very imperfect type of the original. The reproductive process generally advances very rapidly, so much so that the person soon acquires an excellent use of the affected parts. It is upon a knowledge of this property in tendon, when subcutaneously divided, to speedy reunion, that is founded the operation of tenotomy, one of the greatest improvements in modern surgery.

When a tendon is divided in an open wound, the two ends rarely reunite at all, owing mainly to two circumstances; the first is, that the ends retract too far to enable us to bring them properly together, and the second, that the wound nearly always suppurates; an occurrence eminently inimical to adhesive action. All the earlier operations of tenotomy that were performed according to this principle, failed in consequence of the violence of the resulting inflammation.

The *treatment* of a divided tendon, then, with an open wound, is very different from that where the wound is subcutaneous. In the latter, the application of a bit of adhesive plaster to the puncture to exclude the entrance of the air, and a little attention to rest and position, make up the whole sum of the surgeon's duty. In the former, on the contrary, the cut ends must be carefully approximated by the silver suture, the rest of the wound being firmly closed; or the limb with which the tendon is connected must be placed in the most thoroughly relaxed position possible, in order to approximate its extremities, and thus afford them an opportunity of reuniting, an occurrence, however, which, I am sure, will rarely take place under any circumstances, however propitious. The experiments of Dr. Levert, of Mobile, performed many years ago, prove that union between the

divided ends of a tendon will be much more likely to proceed kindly and satisfactorily, when the parts are held in contact by a metallic suture than by an ordinary one. My opinion is that practitioners have not profited enough by the results of these researches. The recent introduction of silver wire, by Dr. Sims, into our surgical armamentarium, will, no doubt, tend to re-excite attention to them.

The surgeon is sometimes consulted on account of an ununited tendon, with an intervening gap, perhaps, long after the external wound has healed. Under such circumstances, it has been proposed to puncture the retracted extremities subcutaneously, and it has been alleged that such a procedure is not only safe, but generally quite successful. Safe it undoubtedly is, but as to its being successful, that is an utter impossibility, unless, what seldom happens, the two ends remain in close proximity with each other. The proper remedy is to expose the parts by a free incision, and having pared the retracted extremities, to unite them with silver wire.

2. *Rupture.*—Tendons are sometimes torn away from their sheaths along with the fleshy fibres into which they are inserted, hanging, perhaps, merely by one extremity; when this is the case, it would be useless to replace them, even if this were practicable, as there would be no likelihood whatever of reunion; on the contrary, severe inflammation and sloughing would be inevitable.

When a tendon is ruptured subcutaneously, a loud snap, like the crack of a whip, is generally heard at the moment of the accident, especially if the cord be a large one; the part is instantly deprived of its functions, and a well marked gap, interval, or hollow is perceptible at the site of the injury. More or less inflammation follows, and a long time usually elapses before the patient regains the use of the affected limb. The tendon which is most liable to suffer in this way is that of the heel, its rupture being generally caused by violent muscular exertion, either for some special effect, as in the case of persons on the stage, or for the purpose of saving the body from a fall, as when the individual makes a false step.

The treatment of a subcutaneously ruptured tendon must be conducted by rest and complete relaxation of the affected structures, so as to enable us to bring the divided ends as closely together as possible. To effect this to the best advantage, special apparatus is generally required, as well as the greatest attention and vigilance on the part of the practitioner. The time necessary for obtaining satisfactory union varies, on an average, from six to eight weeks.

3. *Dislocations.*—The tendons are sometimes dislocated, or thrown out of the grooves in which they are naturally situated, in consequence of the laceration of the connecting ligaments, or retaining bands. The accident, which is most apt to befall the tendon of the two-headed flexor of the arm, as it runs along the bicipital groove of the humerus, is generally attended with severe pain at the site of the injury, inability to move the affected limb, and more or less discoloration of the integuments. Considerable swelling often follows, and, if the accident is overlooked, permanent lameness may result. Replacement should be effected as speedily as possible, and it is gratifying to know that this

is usually quite easy, provided the true nature of the case is recognized soon after its occurrence.

4. *Hypertrophy.*—Finally, the tendons are occasionally the subjects of hypertrophy, exhibiting an irregular, knotty appearance, which is not only unseemly but sadly productive of discomfort. The affection is most common in gouty, rheumatic, and syphilitic persons, and is usually very readily detected both by touch and sight. The proper remedies are removal of the exciting cause, the exhibition of iodide of potassium, either alone, or in union with mercury, and sorbefacient applications.

5. *Thecitis.*—Inflammation of the sheaths of the tendons, technically called thecitis, may originate as an independent affection, or, as not unfrequently happens, it may begin consentaneously with inflammation of the parts which it surrounds and lubricates. In either event, the disease is often of a much more serious character than is generally imagined, nothing short, perhaps, of permanent lameness and deformity being the result. Various causes may give rise to thecitis; thus it is occasionally induced by gout, rheumatism, syphilis, and exposure to cold. On the other hand, it often supervenes upon external injury, as a sprain, blow, puncture, or contusion. In the hand and fingers it is frequently met with as a consequence of dislocation of the wrist-joint, or fracture of the lower extremity of the radius and ulna. In regard to its character, it may be acute or chronic; more generally perhaps the latter than the former. Once fairly established, it is commonly removed with much difficulty, and is liable, as just stated, to be followed by the most disastrous consequences.

The most common sites of thecitis are the sheaths of the tendons of the fingers, the wrist, elbow, feet, ankles, and knees; the disease may occur by itself, or in union with inflammation of the burses and the lining membrane of the neighboring joints. In thecitis of the hands and fingers it is seldom that the disease exists except in this association, especially when it has been caused by a sprain, dislocation, or fracture of the radio-carpal articulation. Under such circumstances, as I have had frequent occasion to notice, the inflammation is extremely apt to extend to the sheaths of all the tendons, as well as the joints of the fingers, rendering them stiff, tumid, and exquisitely painful. If the case be neglected, misunderstood, or improperly treated, the whole hand becomes rigid, and the fingers wasted and attenuated, presenting more the appearance of the claws of some of the inferior animals than the organs which represent those parts in the human subject. The pain accompanying this form of thecitis often reaches as high up as the axilla, and I have known it to be so distressing at night as to deprive the patient completely of sleep for days together.

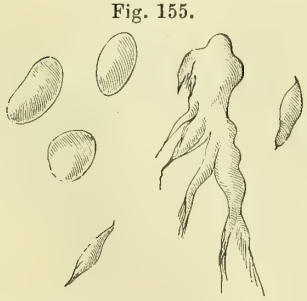
Thecitis, although apparently a trivial disease, assumes a most important character when it invades a number of thecæ simultaneously, or successively, and the gravity of the case is greatly augmented if there is at the same time considerable involvement of the neighboring joints, as when the attack takes place in the hands and fingers. Hence no time should be lost, and no pains spared, to get rid of the inflammation before it has produced any serious structural changes, particu-

larly firm and extensive adhesions of the thecæ to their tendons. Leeches and tincture of iodine, either alone or in union with saturnine and anodyne fomentations, are the chief topical remedies upon which reliance is to be placed, while the patient is freely purged and restricted in his diet. Venesection and antimony will be necessary if the case prove obstinate. If the disease is found to be associated with a gouty or rheumatic state of the system, wine of colchicum will be of service. In thecitis dependent upon a syphilitic state of the constitution, recourse must be had to iodide of potassium.

If the parts have become stiff in consequence of firm adhesions, the hot and cold douche, followed in immediate succession, along with frictions with sorbefacient liniments, embrocations, or unguents, steady, systematic passive motion twice a day, and the application of the bandage, to support the affected structures, will gradually, though in general not under several months, effect restoration. In obstinate cases a mild mercurial course may become necessary, on the same principle that such a plan is occasionally adopted in inflammation of other tissues attended with plastic effusions and morbid adhesions. When the disease is located in the hand, I have generally found it expedient to bandage each finger separately, and to support the member upon a carved splint. In short, in many of these cases nothing but the most zealous and determined perseverance will enable us to effect a cure.

6. *Ganglion.*—A ganglion is a small circumscribed cyst, situated along the course of a tendon, to which it is intimately united. Composed of a single layer, which rarely exceeds the thickness of the dura mater, it is filled with a thin, yellowish fluid, more or less ropy in its character, and bearing a very strong resemblance, in its general features, to olive oil, the white of an egg, or a solution of gum Arabic. In cases of long standing, the contents of the sac are sometimes nearly entirely solid, consisting of a thick ropy substance, of a dark color, not unlike currant-jelly; of masses, apparently, of semi-organized lymph; or of small bodies, similar, in shape and size, to cucumber seed. In a ganglion of the hand upon which I operated two years ago, I observed the singular looking bodies sketched in the accompanying cut (fig. 155). They appeared to be in different stages of development, and were evidently merely so many masses of lymph, which had been originally attached to the inner surface of the sac, but had become separated in consequence of the continual friction of the tendon to which the sac was connected.

Fig. 155.



Fibroid bodies of a ganglion.

The volume of the cyst varies from that of a pea to that of a pigeon's egg; it is of a globular or ovoidal shape, somewhat elastic, perfectly movable, free from pain, and unaccompanied by any discoloration of the skin. A sense of stiffness and of uneasiness, felt chiefly along the course of the tendon on which it is situated, some-

times attends its formation, and induces the patient to apply for advice. I have never known a ganglion to suppurate.

The tumor is most common in the female, and is met with chiefly along the extensor tendons on the back of the hand, wrist, and lower extremity of the forearm. I recollect seeing, some years ago, a case where it was situated over the radial artery, the pulsations of which were so thoroughly imparted to it as to induce the belief, on the part of several physicians who examined it, that it was an aneurism of that vessel. In 1854, I operated before the medical class of the University of Louisville, upon a young woman who had two tumors of this kind, each of the size of a small bird's egg, upon the dorsal surface of the foot.

How this cyst is formed is still a mooted point. From what I have seen of it, I am inclined to regard it merely as a sacculated expansion of the sheath of the tendons, and not, as some pathologists do, as a new formation. From the fact that it is most common in hard working people, it, doubtless, owes its origin to inflammation, although it is seldom directly chargeable to external violence.

The most simple and certain method of treatment consists in rupturing the ganglion, and scattering its contents into the surrounding cellular substance, where they are in general speedily absorbed. I usually perform the operation with the thumb, but, if the cyst is old and very firm, it will be necessary to strike it with a book, or to pierce it previously by a subcutaneous puncture. Evacuation having been effected, a compress inclosing a piece of coin is tied upon the part, to promote the adhesion and obliteration of its cavity, the limb being maintained at rest until the resulting inflammation has subsided. When the ganglion is quite young, a cure may sometimes be procured by the application of iodine and systematic compression; but ordinarily such means are quite futile. Iodine is sometimes employed as an injection, in the same manner as in hydrocele: experience, however, offers nothing in favor of the treatment. When the ordinary means fail, the sac should be cut up as minutely as possible with a delicate bistoury, inserted subcutaneously, the operation being followed up by compression. Both excision and direct incision must be avoided, as likely to endanger the functions of the part.

SECT. III.—SYNOVIAL BURSES.

The synovial burses, bursæ mucosæ, or mucous pouches, exist in considerable numbers in various regions of the body, especially about the joints of the extremities, being small, semi-transparent sacs, occupied by a thin, unctuous fluid. They are for the most part interposed between bone and tendon, tendon and tendon, bone and skin, or tendon and skin, their object being to facilitate motion and ward off pressure. Hence, they are always most conspicuous in those situations which are habitually subjected to friction; and for the same reason they are occasionally developed to meet special contingencies arising

from accidental causes, as the pressure of a shoe, crutch, or artificial leg. In club-foot synovial pouches are constantly found upon those parts of the foot which, being partially displaced, are compelled to sustain the weight of the body. Altogether there are about one hundred and fifty of these sacs in the natural state.

The largest and most important synovial pouches, surgically considered, are situated on the acromion process of the scapula, the space between the hyoid bone and thyroid cartilage, the condyles of the humerus, the olecranon process, the styloid projections of the ulna and radius, the tuberosity of the ischium, the great trochanter, the anterior superior spine of the ilium, the front of the patella, the condyles of the femur, the tuberosity of the tibia, the ankle, the calcaneum, and the heads of the first and fifth metatarsal bones, at their palmar aspect.

The principal diseases of the burses are inflammation, suppuration, induration and thickening, dropsical accumulations, and the development of fibro-cartilaginous concretions in their interior. It does not seem probable that they are ever the seat of any of the heteroclite formations; at all events, I have never met with any examples of them.

Inflammation of these sacs may occur either in an acute or a chronic form, the latter being, however, by far the more frequent. The usual cause is inordinate and long continued friction conjoined with pressure. The disease may also be produced by blows, contusions, wounds, and punctures, and, in persons predisposed to gout, rheumatism, scrofula, and syphilis, by exposure to cold, or the sudden repulsion of the cutaneous perspiration. The housemaid's knee, and the collier's elbow, are examples of inflamed and enlarged burses produced under the influence of concentrated and protracted pressure; another instance, not less striking, is afforded by the bunion which so frequently forms over the inner surface of the metatarso-phalangeal articulation of the big toe.

1. *Acute inflammation* of the burses is generally productive of very severe suffering; the pain is tensive, throbbing, persistent, and greatly aggravated by motion, pressure, and dependency; the swelling, which is often considerable, is usually due partly to exterior deposits, partly to an accumulation of synovial fluid, the quantity of which is commonly very much increased; the skin is of a dusky reddish color, and deeply congested; and the functions of the affected structures are greatly impaired, if not completely arrested. Not unfrequently the swelling is of an œdematous, or erysipelatous character, pitting readily under pressure, and being the seat of a dull, heavy, prickling sensation. In the more severe forms of acute bursitis, there is usually considerable constitutional involvement, the patient being feverish, thirsty, restless, and troubled with headache, loss of appetite, and other disagreeable symptoms.

Upon cutting into the affected sac, its inner surface is found to be deeply congested, and roughened with lymph, while its cavity is filled with a bloody, serous, or sero-oleaginous fluid, often in considerable quantity, especially if the disease has been of some standing.

Bursitis occasionally passes into *suppuration*, the symptoms, when this is about to occur, suddenly assuming a more severe form, just as when matter is about to be deposited in any other part of the body. The pus, which is usually of a thin, oleaginous character, intermixed with flakes of lymph, may find its way to the surface by ulcerative action, or it may discharge itself into a neighboring joint, although such an event is extremely rare, and is not likely to occur unless the joint has freely participated in the inflammation.

The *treatment* of this disease must be actively antiphlogistic; the part and system are kept perfectly at rest; leeches are applied to the affected surface, followed by anodyne and saturnine fomentations; the bowels, diet, and secretions are duly attended to; and the pain, which is generally severe, is controlled by morphine, or morphine, antimony, and aconite. If matter form, as denoted by an increase of pain and other symptoms, a free and early incision is made, the edges of the opening being kept asunder by a small tent to prevent reaccumulation. The milder forms of bursitis are generally easily combated by rest, cooling laxatives, and the application of the tincture of iodine, or, what is frequently preferable, a blister, large enough to extend over the affected surface, and retained sufficiently long to produce thorough vesication.

2. *Chronic inflammation* of the burses occasionally gives rise to remarkable structural changes, the most common of which is an indurated and hypertrophied condition, the result either of long-continued interstitial deposits, or of the formation of adventitious membranes. However this may be, the walls of the affected sac are sometimes found to be upwards of a quarter of an inch in thickness, and of a dense fibro-cellular consistence, without the slightest trace of its primitive characters. Under these circumstances, the cavity of the pouch is generally very small, filled with altered synovial fluid, and roughened upon its surface, so as to exhibit an appearance not unlike that of a honeycomb. Now and then shreds of lymph are stretched across its interior, dividing it into different compartments. In cases of very long standing, partial ossification of the cyst has been noticed, but such an occurrence is extremely uncommon.

These chronic enlargements of the burses are often very obstinate and troublesome, resisting not unfrequently the best directed efforts of the surgeon for their removal. The remedies upon which our chief reliance is to be placed are sorbefacient applications, as iodine and hydrochlorate of ammonia, blisters, mercurial inunctions, and systematic compression. When, these means failing, the tumor is productive of pain and other inconvenience, our only resource is thorough excision, care being taken, especially if a large joint be close by, not to cut too widely away from the morbid mass, lest the synovial membrane of the articulation be inadvertently pierced, or so much injured as to excite violent inflammation.

3. Another result of chronic inflammation of these bodies is an accumulation of their natural secretions, giving rise to what is called *dropsy*, of which one of the best examples is afforded in the so-termed

housemaid's knee. The fluid, which varies in quantity from a few drachms to six or eight ounces, according to the size and situation of the affected burse, and the duration of the disease, is generally of a pale straw color, of a slightly unctuous consistence, and of a notably saline taste; now and then it is reddish, or brownish, and remarkably thick and viscid. It is readily coagulable by heat, alcohol, and acids, showing that it is essentially composed of albumen. The presence of the fluid is easily detected by the elastic and fluctuating character of the swelling, and very frequently a distinct friction sound and sensation can be perceived upon handling the tumor; if necessary, an exploring needle is used. The integuments are free from discoloration; there is no enlargement of the subcutaneous veins; and the principal inconvenience experienced by the patient is of a mechanical nature. Now and then there is a good deal of pain, but more generally simply a sense of soreness and stiffness.

The size and shape of the tumor formed by these dropsical collections are subject to great diversity; in general, it does not exceed the volume of an orange, or a goose's egg, but there are cases in which it reaches the bulk of a fœtal head, although this is very uncommon. Its shape is generally irregularly rounded, or ovoidal, with a compressed, flattened appearance.

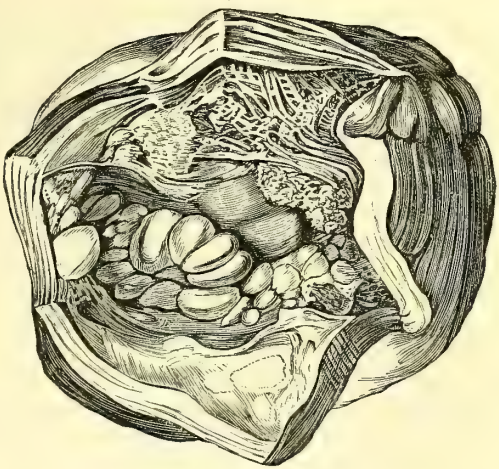
Dropsy of the synovial pouches may often be relieved, in its earlier stages, by the diligent application of iodine, astringent and sorbefacient lotions, and, above all, by blisters; conjoined with rest, attention to the bowels, and the use of the bandage. In cases of long standing, however, such treatment is seldom of any permanent advantage, nothing short of a complete and radical change in the action of the secernent vessels answering the purpose. With this view, the water being drawn off with a trocar, the same remedies may be adopted as in the treatment of hydrocele, that is, injections of stimulating fluids, as tincture of iodine, nitrate of silver, or iodide of iron; or, what I deem better, because more certain, the introduction of a small seton, retained for a period varying from three to six days, according to the amount of the resulting inflammation. In either case, the part is carefully kept at rest, and every precaution used to prevent undue morbid action. When the tumor has become solidified and nearly of its original size, it is an evidence that the seton should be withdrawn. From three to six weeks will usually elapse before a complete cure is effected.

The operation by incision is sometimes practised in these dropsical accumulations; but as it is not only severe, but liable to be followed by violent inflammation, sometimes seriously implicating a neighboring joint, it ought, in my judgment, to be abandoned.

4. Intermixed with the fluid above described, or occurring by themselves, there are occasionally *loose concretions*, of a dense fibrous, fibrocartilaginous, or cartilaginous consistence, which, from the peculiarity of their appearance, and the troublesome symptoms they occasion, have always been a source of interest with practitioners. They are generally of a light yellowish color, and of a flat oval form, not unlike

small melon seeds. Their number is sometimes very remarkable, upwards of fifty having been extracted from a single pouch. The adjoining sketch (fig. 156) affords a good idea of the appearances of these bodies, as they are exposed on dissection, and also of the changes which the burse has undergone in consequence of their presence. When existing in considerable numbers, a careful examination will rarely fail to detect their true character. The symptoms which they occasion are such as usually attend chronic bursitis.

Fig. 156.



Fibroid bodies of a synovial burse.

How are these bodies formed? Two theories have been advanced upon the subject. According to one, they consist essentially of plastic matter, originally poured out in soft amorphous granules or flakes, which, increasing in size and density, are gradually moulded into a determinate shape by the pressure of the surrounding parts, as well as by the friction which they exert upon each other as they are pushed about from place to place in their confined situation. The other explanation is that they are originally connected to the inner surface of the sac, from which they receive temporary support and nourishment; but, finally becoming detached, in consequence of the constant friction to which they are subjected, they present themselves as loose bodies, of the shape and consistence here assigned to them. To my mind, this explanation is the more correct of the two; it is certainly favored by the results of dissection, in which we not unfrequently see some of these bodies still firmly adherent to the inner surface of the affected pouch, and by the analogy which exists between them and the concretions met with in some of the movable joints, which, there is reason to believe, are always formed in this manner.

The only way to get rid of these bodies is to effect their extrusion by free incision, a tent being afterwards placed in the bottom of the sac, to promote its obliteration.

Bodies, closely resembling small hydatids, have occasionally been found in these pouches. J. Cloquet met with an instance in which there were upwards of one hundred and forty, varying in size from one to three lines in diameter, nearly transparent, and of a lenticular shape. They were situated in a large burse, between the great trochanter and the tendon of the great gluteal muscle.

SECT. IV.—APONEUROSES.

The aponeuroses, considered by themselves, offer very little of interest in a surgical point of view, since their diseases are not only infrequent, but very imperfectly understood. From the intimate relations which they sustain, on the one hand, to the muscles, and, on the other, to the areolar tissue, it is obvious that there can be but few diseases or injuries, of a serious character, of these structures, without more or less mutual involvement. At the same time, it is evident that the aponeuroses, from their peculiar arrangement, must necessarily, in many cases, play a very important part, in preventing the extension of morbid action to the muscles which they serve to inclose, just as the periosteum impedes the propagation of disease to bone, and, conversely, from bone to the surrounding textures. This barrier, of course, is often broken in both cases, and then the ravages of the morbid action will be likely to be both rapid and extensive, as we see exemplified in the worst forms of erysipelas, carbuncle, and traumatic inflammation, in which every variety of structure is rudely and indiscriminately assailed by inflammation, not unfrequently terminating, in a few days, in the destruction of an entire limb.

Acute inflammation of the aponeuroses is an uncommon occurrence, and is chiefly observed as a consequence of external injury, or as an effect of erysipelas, carbuncle, and whitlow. It is generally believed that gout and rheumatism are exclusively seated in the fibrous envelops of the muscles, but the probability is that the tendinous, ligamentous, and bursal structures are nearly always implicated along with them, the two diseases sometimes beginning in the former, and sometimes in the latter, but usually ultimately attacking the whole of them.

A bad form of inflammation of the aponeuroses is occasionally produced by punctured wounds, especially when occurring in the palm of the hand and sole of the foot, in persons of broken constitution, dissipated habits, or nervous temperament. The disease soon assumes an erysipelatous disposition, and leads to excessive suffering, both local and constitutional; occasionally it is followed by tetanus.

Inflammation of the aponeuroses manifests but little disposition to pass into suppuration, ulceration, or gangrene.

Chronic inflammation of these membranes is much more common than the acute, and leads to various alterations of structure, as thickening, atrophy, and induration. Sometimes we find them affected with slight ossification, the new substance presenting itself in the form of bony spicules; and I have met with cases where, from longitudinal pressure, they were remarkably attenuated, and pierced with numerous holes, giving them a sieve-like appearance.

I am not aware that the aponeuroses are ever the seat of any of the heteroclite formations; dissection, however, has shown that they are occasionally affected by them secondarily.

The *treatment* of aponeurotitis must be conducted upon ordinary antiphlogistic principles. Anodynes must be exhibited in full and repeated doses to relieve pain and nervous symptoms; if plethora

exists, and the local action is severe, blood must be taken from the arm and by leeches from the affected parts; the bowels must be freely moved; and recourse must be had to the saline and antimonial mixture. Free incisions are made if much tension be present, or the formation of matter be threatened; followed by medicated fomentations and emollient poultices.

Aponeurotitis dependent upon a gouty, rheumatic, or syphilitic state of the system, must be managed according to the general principles of treatment laid down for the relief of these affections, such as colchicum, iodide of potassium, and mercury, in combination with other suitable means.

CHAPTER III.

DISEASES OF THE LYMPHATIC VESSELS AND GANGLIONS.

THE pathologist can certainly not boast of his knowledge of the diseases of the lymphatic vessels; he knows, it is true, that they are liable to inflammation, but of the manner in which it is produced, and of the effects to which it gives rise, he is, in great measure, ignorant. That these vessels play an important part in various affections is extremely probable; but such are their excessive tenuity and the great delicacy of their structure that no one has yet been able to point out the character and amount of their participation. It has been supposed that at least one form of cutaneous disease, namely, erysipelas, essentially consists in inflammation of the absorbents, and it must be confessed that the opinion, although insusceptible of demonstration, is highly plausible.

SECT. I.—LYMPHATIC VESSELS.

Inflammation of these vessels, technically called *angeioleucitis*, or *lymphatitis*, has hitherto been studied to most advantage in connection with external injuries, particularly punctured and poisoned wounds, of which it is by no means an infrequent consequence. Doubtless, the disease is sometimes idiopathic, or dependent upon internal causes, such as give rise to erysipelas and other bad forms of inflammation in the cutaneous and other tissues. When arising as a consequence of an abrasion, or the prick of a needle, as in sewing up a dead body, the affected vessels can be easily traced as they pass beneath the skin, as small reddish cords, tense, nodulated, and painful to the touch, accompanying the principal veins, and extending as far as the nearest ganglions, in which they appear to terminate. The number of these reddish lines is variable; sometimes there are only two or three, while at other times there are as many as six, ten, or a dozen, forming a kind of band, from half an inch to an inch in width. Whenever the number is considerable, there is always a good deal of concomitant swelling; and the parts, feeling stiff, sore, and tender, readily pit on pressure, owing to the effusion of sero-plastic matter. In the more severe attacks of angeioleucitis, as those consequent upon inoculation with putrid or poisonous matter, the tumefaction soon becomes general, spreading rapidly over the whole limb, and the discoloration, losing its striated appearance, so characteristic of the disease in its earlier

stages, also assumes a diffusive disposition. Arrived at this point, it is usually impossible to distinguish this affection from ordinary erysipelas, so closely do the two lesions resemble each other.

Occasionally the inflammation seems to take its rise in the deeper layers of vessels, when the discoloration is generally preceded by considerable induration of the subcutaneous areolar tissue, giving the part a kind of brawny sensation; by and by, however, red streaks appear in the skin, and then the disease follows pretty much the same course as when it begins in the superficial vessels.

However originating, the disease nearly always involves the neighboring lymphatic ganglions, causing them to enlarge, and to become tender, red, and painful. In some of the worst forms of angeioleucitis, the glands manifest signs of being diseased before the absorbents themselves are apparently implicated. Such an occurrence, although uncommon, is occasionally met with in inflammation of these vessels consequent upon dissection wounds.

Angeioleucitis no doubt sometimes passes into suppuration, and, perhaps, even into gangrene; but of these occurrences, as pure, uncomplicated affections, our knowledge is too imperfect to justify us in speaking positively.

The *symptoms* ushering in an attack of angeioleucitis are usually such as are denotive of constitutional depression, following pretty closely upon the injury sustained by the affected vessels. The patient, after having felt indisposed for some hours, seldom more than from twelve to twenty-four, is seized with chilly sensations, accompanied with flushes of heat, a disposition to yawn, headache, pain in different parts of the body, and a dry and contracted state of the skin. Sometimes the attack is ushered in by violent rigors, soon succeeded by high fever, and delirium. If the local affection be at all severe, the symptoms soon assume a typhoid character, the pulse becoming weak and frequent, the surface hot and dry, and the tongue covered with a brownish fur. The local distress, meanwhile, increasing, abscesses form in different portions of the limb, the matter being of a foul, unhealthy character, and disposed to spread extensively among the surrounding structures, in the same manner as in erysipelas and other bad forms of inflammation.

Angeioleucitis may be confounded with other diseases, particularly erysipelas and phlebitis, and the distinction is by no means always so easy as might at first sight appear. In fact, it can only be made out satisfactorily in the earlier stages of the complaint, the principal source of diagnosis being the red striated appearance of the affected surface, reaching from the seat of the injury up to the nearest lymphatic ganglions. In phlebitis, the discoloration is also linear, but the cords are much larger, firmer, more knotty, and more deeply seated; they are also less numerous, and there is not near so much involvement of the lymphatic glands. In erysipelas, the inflammation usually begins as a circumscribed affection, with diffuse, uniform redness, not striated, as in angeioleucitis, or in phlebitis.

In the *treatment* of this disease, the same general principles are to be observed as in the treatment of erysipelas and phlebitis, to which

it bears so close a resemblance. The exciting cause being removed, such local and general means are to be employed as may seem to be best adapted to the exigencies of each particular case. Bearing in mind that, if the disease be at all severe, the symptoms will be likely soon to assume a typhoid character, the surgeon will take care not to deplete much, especially with the lancet and purgatives, lest he be instrumental in inducing fatal exhaustion, of which the danger may be already sufficiently great in consequence of the progress of the morbid action. Leeches may be applied along the course of the affected vessels, but not directly over them, if the disease is in its earlier stages, and the patient is robust and in the prime of life. They should be employed in considerable numbers, and be succeeded by warm fomentations, the whole limb being enveloped in flannel cloths wrung out of a strong solution of acetate of lead and opium, and kept constantly wet. The application of iodine will also be found advantageous; also, a long, narrow blister, stretched along the course of the affected vessels, and retained for a sufficient length of time to produce thorough vesication. If matter form, or great tension and throbbing exist, suitable incisions must be made.

The constitutional treatment must be regulated by the character of the general symptoms. Purgatives, to clear out the bowels and correct the secretions; iron, or iron and quinine, to improve the tone of the system and the state of the blood; and anodynes, to allay pain and induce sleep, with a properly regulated diet; will constitute the most reliable and efficient means. If marked debility arise, brandy, wine, or porter, with nutritious broths, will be required. When the disease proves obstinate, or becomes chronic, a mild mercurial course will be beneficial.

Varicose enlargement of the lymphatic vessels has occasionally been noticed, although the occurrence is extremely uncommon. In the case mentioned by Carswell, of a young man, twenty-six years old, a tumor nearly as large as an orange existed in each groin, for which he had worn a double truss from his boyhood, under the supposition that he had hernia. On dissection, however, each tumor was found to consist of enormously dilated absorbent vessels connected with the inguinal ganglions. When cut into, instead of presenting a solid, compact structure, it had the appearance of a coarse sponge, most of the vessels being from one to three lines in diameter. The same phenomenon was witnessed, only in a more striking degree, in the lymphatics of the pelvic and lumbar regions. The spongy and elastic character of such a swelling ought to prevent any serious error of diagnosis. Hardly any treatment would be necessary in such a case. Excision might prove dangerous, and should not be practised without due deliberation.

SECT. II.—LYMPHATIC GANGLIONS.

The lymphatic ganglions are liable to inflammation, chronic enlargement, or hypertrophy, carcinoma, tubercle, earthy degeneration, and fibro-plastic tumors.

Inflammation of these bodies, technically called adenitis, may show itself either as an acute or a chronic affection, and is of such remarkable frequency as to demand special consideration. In whatever form it occurs, it is most common in young children of a strumous predisposition, and is generally brought on by attacks of cold, or by some local irritation implicating the afferent lymphatic vessels. The disease, moreover, may be common or specific, of the latter of which illustrations are afforded in syphilitic bubo, in the bubo of plague, and in the swelling of the lymphatic ganglions of the axilla, consequent upon dissection wounds and malignant pustule.

1. *Acute adenitis* is most common in the ganglions of the neck, jaw, and supra-clavicular region; it is also occasionally met with in those of the groin and axilla. The disease may be limited to one of these bodies, or, as is more generally the case, affect a considerable number of them; beginning as a hard, painful knot, exquisitely tender to the touch, and rapidly increasing in size, until, in some instances, it attains the volume of an almond or a pullet's egg. The increase in the size of the tumor is sometimes exceedingly rapid, as we often see in adenitis of the neck from exposure to cold, where a body of this kind, scarcely perceptible in the natural state, may, in the course of a few hours, acquire the size of a filbert or a small marble. As the disease advances, the swelling extends to the connecting areolar tissue, the skin becomes red and inflamed, and the parts pit on pressure. The discoloration is not unfrequently of an erysipelatous character. When the inflammation is fully developed, the local distress is usually very severe, and the constitution actively sympathizes with the suffering textures, the patient being feverish, deprived of appetite and sleep, and affected with constipation.

Dissection shows the affected ganglions to be of a deep reddish or brownish color, infiltrated with sero-plastic fluid, softened, lacerable, or easly crushed with the finger; the cellular tissue around is also abnormally vascular and infiltrated, and, in many cases, it seems to be the principal seat of the morbid action.

Adenitis may end in delitescence or resolution, pass into suppuration, or assume a chronic character. The occurrence of gangrene is very uncommon.

Adenitis sometimes vanishes in a few hours, either spontaneously, or under mild treatment. We often see enlarged and inflamed ganglions of the neck, or at the angle of the jaw, most rapidly disappear under frictions with ammoniated liniment, aided by hot drinks and immersion of the feet in hot water, or simply warming the feet near the fire. When the inflammation is more severe, an active purgative will be necessary, followed by a gentle diaphoretic, as one-fourth of a grain of morphia with one-half that quantity of tartar emetic. The diet must be light, and the part and system must be kept perfectly at rest. If the inflammation threaten to prove troublesome, or to pass into suppuration, leeches and medicated fomentations must be employed. In many cases the dilute tincture of iodine will be beneficial in cutting short the disease.

When adenitis passes into *suppuration*, matter generally begins to

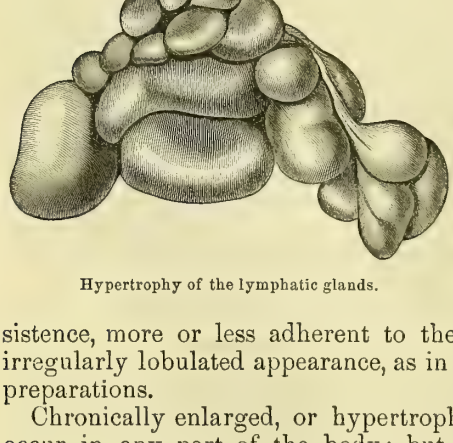
form from the fifth to the tenth day; sooner or later, according to circumstances, this event being generally most rapidly excited in young, weakly, or scrofulous children, with an impoverished state of the blood. The pus is not always situated in the enlarged ganglions; in many cases, in fact, it is limited, in great degree, if not entirely, to the neighboring areolar tissue. It is of a light yellowish color, verging on greenish, thick, and often very copious; occasionally it is mixed with blood, and with the debris of the affected ganglions. Finally, the matter may occur as an infiltration, or as a distinct abscess.

The occurrence of suppuration is announced by increased heat, pain, redness, and swelling, along with a sense of throbbing, and by high constitutional disturbance, attended by chilly feelings, or even rigors, followed by fever and perspiration.

The *treatment* is strictly antiphlogistic. If the phenomena are clearly denotive of the existence of pus, an early incision is made, free and dependent, to favor thorough evacuation and prevention of reaccumulation. The operation is followed by warm water-dressing or an emollient cataplasm. The use of a tent will occasionally be required to maintain patency of the puncture.

2. *Chronic* adenitis is a very common occurrence; it generally succeeds to the acute variety of the disease, but there are cases in which it is seemingly, although not in reality, a primitive affection. However this may be, its effect is gradually to produce enlargement and induration of the affected bodies, until, in many cases, there is a complete subversion of the natural structures. In the earlier stages of the disease, the gland is of a reddish, brownish, mottled hue, considerably increased in size, and of a firm, fleshy consistence; by and by, however, it assumes a grayish or whitish aspect, becoming almost homogeneous, and cutting very much like an unripe apple or pear; in some cases it is quite soft and lacerable. When the transformation is very great, the hardness of the gland may be equal to that of scirrhus, with which it is then liable to be confounded. A distinct capsule, composed of dense cellular substance, generally surrounds the enlarged body, which is capable, under such circumstances, of attaining a volume equal to that of a small orange. When a number of such ganglions are agglomerated together, a large tumor is formed, of a hard, firm consistence, more or less adherent to the neighboring parts, and of an irregularly lobulated appearance, as in fig. 157, copied from one of my preparations.

Fig. 157.



Hypertrophy of the lymphatic glands.

Chronically enlarged, or hypertrophied lymphatic ganglions, may occur in any part of the body; but they are most commonly met

with in the neck, or about the lower jaw. In the internal cavities they are most frequently seen in the mesentery and pelvis, and at the root of the lungs. The effect which these bodies exert upon the structures among which they are situated, is principally of a mechanical character; compressing them, and so interfering more or less with the exercise of their functions. Thus, in the neck they may cause injurious pressure upon the trachea, vessels, and nerves; in the pelvis they may interfere with parturition by preventing the descent of the child's head; while in the lungs they may occasion suffocation by obstructing the entrance of air into the bronchial tubes.

Various causes may give rise to this affection; some of a local, others of a purely constitutional nature. In the neck, it is often occasioned by cold, or by disease of the jaw, teeth, gum, or tonsil; in the groin, by ulceration of the penis; in the axilla, by disorder of the mammary gland; in the mesentery, by irritation of the small bowel. The most efficient general cause is a strumous state of the system; but there is reason to believe that the lesion may be produced by anything that has a tendency to derange the general health, or to impoverish the fluids and solids.

Chronic enlargement of the lymphatic ganglions often continues for years, now advancing, then stationary, and now, perhaps, receding; in general, however, the disease is obstinate, especially when the structure of these bodies has undergone serious organic changes, in which case it is often extremely difficult, if not impossible, to reclaim them by any mode of treatment of which we have any knowledge.

The *treatment* of chronic adenitis is both constitutional and local. In the first place, the exciting cause is looked for, and, if possible, removed; the carious tooth is extracted, the ulcer on the penis healed. The general health is improved by attention to the bowels and secretions, and by a strict observance of the laws of hygiene. When plethora exists, detraction of blood, and the antimonial and saline mixture will be of service; under opposite circumstances, the proper remedies will be a nutritious diet, and alterant tonics, consisting of iodide of iron and quinine, bichloride of mercury, iodide of potassium, and cod-liver oil. When there is no contra-indication, minute doses of mercury in Huxham's tincture of bark will often be highly efficacious, but care should be taken not to carry it to profuse ptyalism. Tartar emetic also, given in small doses, as the tenth or twelfth of a grain, three times a day, will frequently prove eminently beneficial. In most cases a regular system of purgation should be maintained. The German practitioners are fond in this disease of the use of hydrochlorate of ammonia, administered in doses of from five to ten grains three times in the twenty-four hours. The article is a powerful sorbefacient, and is therefore worthy of trial, especially in cases refusing obedience to the more ordinary measures.

Among the more important topical remedies are leeches, and sorbefacient liniments, unguents, and embrocations, assisted by systematic and steady compression. These means must be employed with great caution and judgment, otherwise they will be sure to be productive of harm instead of benefit. All sorbefacient applications should, in the

first instance, be of a mild character, their strength being gradually increased as the parts become more tolerant of their impression, and their peculiar effects are rendered more and more apparent. When the enlarged ganglions are favorably situated, compression will often be found a most admirable remedy; it may be applied with the pad of a truss, as in hypertrophy of the inguinal glands, or with a compress and bandage when it affects the glands of the neck, care being taken not to interfere with respiration. In obstinate cases, the application of a blister occasionally exerts a salutary influence, relieving the enlarged structures of engorgement, and stimulating the absorbent vessels so as to induce them to remove morbid deposits. The electric current has sometimes been advantageously used. Subcutaneous division of the enlarged glands, or comminution with the bistoury, has occasionally been practised, but the effects have not been such as to render a repetition of the operation at all desirable.

Finally, when the disease is intractable, our only resource is removal of the morbid mass, provided it is situated favorably for such a procedure. Such a step, however, should not be lightly taken, as it must often involve serious consequences, on account of the deep situation of the tumor, and its connection with important structures. In the cervical region, for example, the excision of a mass of enlarged and indurated lymphatic ganglions not unfrequently proves a most difficult, embarrassing, bloody, and hazardous operation. Removal, however, will be greatly facilitated, if the knife be kept close to the enlarged glands. Sometimes the enlarged and disintegrated organ may be pressed out bodily through a small opening in the integuments. When the diseased mass compresses the trachea or large vessels of the neck, and does not admit of removal, relief must be sought by the subcutaneous section of some of the constricting muscles, especially the sterno-cleido-mastoid.

3. *Carcinomatous* disease of the lymphatic ganglions is occasionally met with as a primary affection, more particularly the encephaloid variety. Scirrhus is extremely uncommon; colloid I have never seen here; while of melanosis I have witnessed only a few instances. As a secondary formation, cancerous disease of the lymphatic ganglions is extremely frequent.

Primary *encephaloid* is most common in the lymphatic ganglions of the groin, axilla, and neck; it occurs in both sexes, and at various periods of life, in children and adolescents, as well as in subjects after the age of fifty. In general, the disease arises spontaneously, but in some cases its origin may be distinctly traced to external injury, as a blow or kick. Its progress is usually very rapid, few persons surviving its attack longer than from six to twelve months. Beginning commonly in one of these bodies, as a hard, smooth, semi-elastic swelling, it soon extends to those in its immediate vicinity, thus often involving a whole group of ten, fifteen, or even twenty. In consequence of this arrangement, the tumor has generally a knotty, lobulated surface, and not unfrequently acquires a large bulk, equalling, or even exceeding, that of a fist. Soft and elastic at one point, it is hard and firm at another, while at a third it is occasionally almost of a fluid

consistence. As it progresses it contracts firm adhesions to the surrounding parts, the skin becomes attenuated and discolored, and the subcutaneous veins assume that peculiar varicose disposition so common in encephaloid in other parts of the body. By degrees, the morbid mass breaks through its confines, ulcerating and fungating, and destroying life either by hemorrhage or by hectic irritation.

Examined after removal, the morbid mass is found to consist of a soft, brain-like substance, inclosed in thick, strong, membranous cysts, representing the original capsules of the affected ganglions, but greatly condensed by the pressure of the contained matter. In addition to these cysts, there is generally a large quantity of filamentous tissue, intersecting the parts in different directions. A grumous looking, semi-organized substance often occurs in these tumors, and there are cases in which they contain serous cysts. In an instance of encephaloid of the axillary ganglions, which I observed in a man fifty-six years of age, there was a cavity of this kind which distinctly fluctuated under the finger, and gave vent, on being punctured, to upwards of eight ounces of sero-sanguinolent fluid.

The diagnosis of encephaloid of the lymphatic ganglions is easily made; the only affections with which it is liable to be confounded being chronic enlargement, and tubercular disease, from both of which it may be distinguished by the history of the case, and the rapid growth and soft consistence of the tumor. In chronic enlargement, the swelling is hard, and often involves a whole chain of ganglions; in tubercular disease the swelling, also very firm, generally manifests a disposition to suppuration, and is nearly always associated with other marks of the tubercular dyscrasia.

The proper remedy is early extirpation, although the disease will be certain to recur, and ere long prove fatal. Such a result will generally occur much sooner in young than in elderly subjects, and it has hence been a question whether they should ever be subjected to operation.

Primary *scirrhus* of the lymphatic ganglions is extremely uncommon; in the few cases in which it has hitherto been observed it occurred in the cervical, inguinal, and axillary regions of elderly persons. The disease is comparatively tardy in its progress, and the tumor, which is distinguished by its great hardness, seldom acquires any considerable bulk. My opinion is, that what is usually considered as scirrhus of these bodies is nothing but fibro-plastic disease.

Melanosis of the lymphatic ganglions (fig. 158) may occur as a primary affection; generally it is associated with melanosis in other parts of the body. I have noticed it in a few instances in the lymphatic ganglions of the groin and axilla, which, I believe, are its most frequent seats. It occurs either as an infiltration, or as an irregular tumor, solid, inelastic, and of variable size and shape.

Fig. 158.



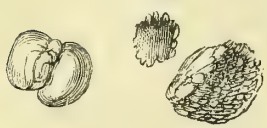
Melanosis of a lymphatic gland.

Tubercular disease of these bodies is met with chiefly in young subjects, before and soon after the age of puberty; most generally in children. Now and then it occurs in elderly persons, but this is

very uncommon. Surgically considered, it is most frequent in the ganglions of the neck and jaw, and may be limited to one of these bodies, or, as is most generally the case, affect a large number of them, either simultaneously or successively. It often co-exists with tubercular disease of the lungs, joints, and other parts. This subject, however, having already been discussed in the chapters on scrofula and tumors, any further remarks respecting it here would be superfluous.

The lymphatic ganglions occasionally undergo the *earthy* degeneration (fig. 159), being converted into a soft, whitish substance, not unlike chalk. Such an occurrence is most common in the bronchial and mesenteric ganglions, but is also sometimes seen in those of the neck. Not long ago, I met with a case in which not less than five of the cervical ganglions had become completely ossified; they were of stone-like solidity, of a light brownish color, rounded, and from the size of a pea to that of a hazel-nut. The patient was a middle-aged, strumous female, and the ganglions, which formed a chain along the inner edge of the sterno-cleido-mastoid muscle, on the right side, had been affected from early youth. Their character was obvious to the slightest touch. Excision was easily effected. Such tumors need not be interfered with, unless they become a source of annoyance by their situation.

Fig. 159.



Cretaceous degeneration of the lymphatic glands.

The *fibro-plastic* tumor is sometimes found in these bodies, the proper tissue of which is replaced by a whitish, dense, solid substance, which, to the naked eye, as well as under the microscope, presents all the characteristic features of this morbid growth. The tumor generally occurs in young subjects, after the age of puberty, and is capable of acquiring a bulk varying from that of an orange to that of a fist. It is easily recognized by its firmness, and slow but steady progress, and by the absence of pain and constitutional involvement. The proper remedy is excision.

CHAPTER IV.

DISEASES AND INJURIES OF THE NERVES.

SECT. I.—WOUNDS AND CONTUSIONS.

NERVES, when divided, readily reunite, the connecting medium being plastic matter, which, being effused between and around the severed ends, is gradually solidified, and transformed into an analogous tissue, capable of transmitting the nervous current, although it does not contain any real nerve-substance. In order, however, that the connection shall be satisfactory, it is necessary that the interval between the two extremities be very short, otherwise the plasma will fail to effect the object, and each end will become expanded into a bulbous mass, having all the characteristics of a neuromatous tumor, similar to that which occasionally forms in the stump after amputation, and liable, like it, to become the seat of neuralgia. It is a curious fact that if a nerve be slowly divided with a ligature the reunion of its extremities will generally be more rapid and complete than when the section is performed with a sharp knife; in the former case there is generally very little retraction of the ends, whereas, in the latter, they sometimes separate to a considerable distance, thus requiring a large quantity of lymph to fill up the gap.

When a nerve is cut completely across, the parts to which it is distributed are necessarily deprived of their functions, an occurrence which, consequently, serves as a diagnostic sign of the accident. Thus, if the nerve be one of motion, the parts will be paralyzed, while, if it be one of sensation, they will be divested of sensibility. If the division be only partial, the loss of function will, of course, be partial also. In general, the structures beyond the seat of injury feel numb and heavy, with a sense of tingling, prickling, stinging, or burning.

Wounds of the nerves must be treated upon general principles. If there be no serious loss of substance, the divided ends should be as closely approximated as possible by attention to position, and, if necessary, by suture of the neurilemma, the needle and thread used for this purpose being of the most delicate kind. Such a procedure is much better than permitting the extremities to become separated from each other, as they are very apt to do when the suture is neglected, either in consequence of their retraction or of the interposition of other tissues. The operation, if carefully performed, will be free from pain, and, if one of the ends of the ligature be brought out at the nearest point of the common wound, no difficulty can arise in regard to its detachment.

A similar procedure may be adopted when a large nerve has been severed, but has failed to reunite, owing to the great distance at which the ends are separated from each other. An incision being made down to the nerve, the two ends are to be carefully retrenched, and then tacked together by several points of suture, apposition being favored by attention to the position of the parts.

Nerves, when *punctured*, pricked, or partially divided, usually occasion severe pain, of a neuralgic character, extending up and down the affected parts, and attended with muscular weakness, perverted sensation, convulsive movements, and derangement of the general health. Such effects not unfrequently follow the operation of venesection at the bend of the arm, in consequence of injury sustained by one of the subcutaneous nerves. The proper remedy is complete division of the affected filament, either subcutaneously, or, when this is impracticable, by free incision. The operation, however, is not always permanently successful, owing to the deep impression made upon the nervous system, the effect of the lesion eventually becoming general. Besides, the divided extremities of the nerve are very apt to take on diseased action, either by being incorporated in the original cicatrice, or by being expanded into a species of neuroma. When this is the case, the proper procedure will be free excision instead of subcutaneous section.

Severe effects often follow *contusion* of the nerves, the parts to which they are distributed becoming numb, cold, withered, more or less painful, and, ultimately, almost entirely useless. Effects of this kind sometimes succeed to accidents of, apparently, the most trifling character. The nerves, so far as we can form an opinion without the light of dissection, soon become inflamed, and are often irretrievably ruined, being effectually and permanently disqualified for the performance of their functions. It is hardly probable that these effects are due, as has been conjectured, to mere concussion of the nerve-substance; if this were the case, they would be much more transient, as well as less severe. What corroborates the idea that inflammation is deeply concerned in the production of the secondary suffering is the fact that the parts, although seriously crippled at the start, do not evince much derangement until the disease is fully established in all its intensity.

Professor Willard Parker has recently described what he calls *concussion* of the nerves. He considers the accident as similar to concussion of the brain, the nerves receiving a shock eventuating in a sudden suspension of their functions. In the paper which he has published on the subject, in the New York Journal of Medicine for September, 1856, he has related six cases illustrative of the nature of the injury. When the paralysis, which is generally temporary, subsides, the affected nerves are in danger of being assailed by inflammation, which, if it cannot be prevented, must be treated in the usual antiphlogistic manner. A long time frequently elapses before recovery takes place, the nerves remaining weak, irritable, and incapable of performing their proper functions. The limb, supplied by the affected nerves, is soon fatigued and exhausted by exercise, and is the seat of a dull, aching, tired sensation, which is always aggravated by exertion,

especially if carried beyond a given limit; in time, it becomes cold, atrophied, and, in great degree, useless. The general health also suffers, though the disease never proves fatal.

The proper treatment, in the first instance, is rest, absolute and unconditional; and, after the nerves have recovered from the immediate effects of the injury, passive exercise, dry friction, and attention to the general health, which, in the more severe forms of the accident, is always materially, if not seriously, impaired.

Severe pain is often produced by the *compression* of a nerve, without, so far as can be determined, any particular disease of the nerve itself. In aneurism, for example, of the larger arteries the patient often experiences extreme suffering from this cause. The pain, in this case, is either sharp and darting, as in certain forms of neuralgia, or of a burning, tearing, boring, or gnawing character, especially if there be at the same time erosion of the osseous and cartilaginous tissues.

SECT. II.—TETANUS.

The term tetanus is a generic one, employed to denote a peculiar affection of the nerves, characterized by violent contraction of the voluntary muscles, with irregular intervals of partial, though seldom of complete, relaxation. Different names have been devised to designate the disease, according to the nature of the predominant local symptoms occasioned by the affected muscles. Thus, when the muscles of the lower jaw are spasmodically contracted, so as to prevent the patient from opening his mouth, the word *trismus* is employed, or, to use a common expression, the person is said to have locked jaw. When the body is bent forcibly forwards by the action of the abdominal muscles, the affection is denominated *emprosthotonos*, and *opisthotonos* when it is drawn backwards by the dorsal muscles. The term *pleurothotonos* is used when the body is drawn to one side. A distinction of much greater importance is that of tetanus into traumatic and idiopathic, acute and chronic. The disease occasionally comes on within a few days after birth, and is then designated as infantile tetanus, the *trismus nascentium* of authors.

In this country, especially in its more temperate latitudes, the surgeon has to deal chiefly with traumatic tetanus, the idiopathic variety being extremely infrequent. Cases of it, however, occasionally occur in the more tropical States of the Union, especially in South Carolina, Georgia, Mississippi, Florida, Louisiana, and Texas; while in the West and East Indies it is sufficiently common. The tetanus of new-born infants occurs chiefly in the southern and southwestern States of North America, in consequence, apparently, of injury sustained in the ligation of the umbilical cord. Infantile tetanus seems to be very common in certain portions of Europe. Thus, it is asserted by Dr. Joseph Clark, that in the year 1782, of 17,550 children born in the Lying-in Hospital of Dublin, 2,944 perished from this cause alone within the first fortnight after birth.

Traumatic tetanus, to which the ensuing remarks are more particularly intended to apply, is not peculiar to any age, to either sex, or to any particular pursuit; on the contrary, it is met with at all periods of life, in females as well as in males, and in all ranks and classes of society, from the most refined and affluent to the most filthy and impoverished. It has been ascertained, however, that the young suffer more frequently than the aged, and that it is particularly liable to occur in persons of a nervous, irritable temperament. Ill health, especially disorder of the digestive apparatus, grief, anxiety of mind, and whatever, in short, has a tendency to depress the energies of the system, powerfully predispose to its development. It is generally stated that men are more prone to traumatic tetanus than women, and the statistics that have been published on the subject would, at first sight, seem to warrant such a conclusion; but it will be found, upon more careful inquiry, that the difference is only apparent, not real, and that it is dependent upon the fact that females are much less obnoxious to the various exciting causes of the disease than the other sex. Blacks and mulattoes are more liable to tetanus than whites. In some portions of the West Indies the disease is almost exclusively confined to the colored population.

Causes.—The causes of traumatic tetanus are, as the term implies, various kinds of external injury, as punctured, lacerated, and contused wounds, burns, scalds, abrasions, compound fractures and dislocations, and surgical operations, as amputations and the excision of tumors. A number of cases have been recorded where tetanus was produced by salivation. Some of the most trivial accidents are, at times, sufficient to produce the disease. Thus, cases have been observed where it followed the application of the scarificator in cupping, the introduction of a seton, and the extraction of a tooth. Baron Larrey mentions an instance in which it was occasioned by the lodgement of a fish-bone in the fauces. Examples of tetanus, consequent upon the ligation of the iliac, femoral, and carotid arteries, have been recorded by Brodie, Dazille, and Dudley. Many years ago, I met with a case where it supervened upon the injection of a hydrocele, the man dying a few days afterwards. Tetanus has now and then followed upon parturition, and that, too, where the labor was apparently of the most simple nature. The fact is, in persons of a nervous, irritable temperament, any injury, however trifling, or insignificant in itself, may readily induce the disease, especially in hot and damp states of the atmosphere, or during sudden transitions from heat to cold. Exposure to cold draughts, by which the body is suddenly chilled, is, under such circumstances, extremely liable to provoke an attack.

The effect of cold air, when permitted to play directly upon the body, is well illustrated by an occurrence that took place after the battle of Ticonderoga, in 1758. The wounded were exposed the whole night after the action, in open boats upon Lake George, and the consequence was that nine of them died of locked jaw. During our war with Great Britain, most of those wounded by fire-arms on board the frigate Amazon, before Charleston, were attacked with tetanus on the fourteenth day, from a sudden change of very wet and cold weather

following a long draught. Wounded soldiers, lying on damp or wet ground, are particularly prone to attacks of this disease.

The injury inducing the disease may be situated upon any part of the body. It was at one time supposed that lesions of the head and face were singularly exempt from tetanus, but more enlarged experience has demonstrated that, although it does not occur with the same relative frequency as when the cause is seated in other regions, yet its invasion after such accidents is by no means uncommon. Injury of the inferior extremity is more prone to be followed by tetanus than a similar affection of the superior extremity; and everybody knows how remarkably liable the disease is to supervene upon wounds involving the tendons and aponeuroses of the hands and feet, especially of the latter. Lesions of the nerves themselves are particularly dangerous in this respect, more especially when they are of a punctured character, or when they are limited to a partial division of their fibres and neurilemma, by a blunt instrument, as a piece of glass or a rusty knife.

The extent of the injury does not, so far as we are able to judge, exert any material influence upon the production of the disease, as it has been known to follow, on the one hand, the most insignificant scratch, and, on the other, the most frightful wound. I believe, in fact, that it may be assumed, as a general principle, that the danger of the occurrence of tetanus is, other things being equal, almost in direct ratio to the diminutive size of a wound. This is certainly true of a majority of the cases that have fallen under my personal observation, an apparently trivial injury, mostly a little puncture, having served as the exciting cause.

Symptoms.—The period which intervenes between the occurrence of the injury and the development of the disease, is liable to considerable variety; but the subject, unfortunately, has not been elucidated by reliable statistics. Enough, however, has been ascertained to prove that it ranges, in the great majority of cases, from four days to a fortnight. In some rare instances, well-marked tetanic symptoms have manifested themselves within several hours after the receipt of the injury, and, on the other hand, cases have occurred where the eruption did not take place under eight or ten weeks. What is remarkable is, that the disease occasionally does not appear until the wound which provokes it is completely closed, owing, doubtless, to some lurking irritation in the nerves of the affected parts.

Although tetanus sometimes comes on suddenly, with hardly any premonition, yet, in general, the attack is preceded by various anomalous nervous sensations which but too surely announce its approach. The most important and reliable of these precursories are, a sense of malaise, or universal uneasiness, aching in the muscles, stiffness about the lower jaw, pain in moving the head, and difficulty in protruding the tongue. If there be a wound, it commonly puts on an unhealthy appearance, discharging a thin, sanious fluid, and manifesting no further disposition to heal. After these symptoms, which are often attributed by the patient to the effects of cold, having continued for a variable, but usually a very short, period, others, more bold and decisive in their

character, set in, leaving no longer any doubt respecting their true nature. The jaw now becomes firmly locked; the faculty of mastication is completely abolished; attempts at deglutition excite spasm in the throat, with a sense of impending suffocation; and there is an indescribable distress in the precordial region, extending from the ensiform cartilage backwards towards the spine, as if the chest were tightly encircled by a cord. The muscles of the back and abdomen are rigidly contracted, and, in no long time, those of the extremities become similarly affected. When their action is very violent, the spinal muscles may shorten themselves so much as to draw the trunk into a distinct arch, the body resting only upon the occiput and heels, the affection thus constituting the variety of tetanus called opisthotonos. The opposite state of this, or emprosthotonos, is extremely uncommon; for, although the abdominal muscles are usually very firmly contracted, being often as hard as a board, yet it is seldom that they are able to counteract the extensor muscles of the back to such a degree as to bend the head and chest forwards. The disease having reached this stage, may be said to be completely and characteristically established. Frequent spasms now occur, convulsing and agitating the whole frame, and greatly increasing the general suffering. The teeth are firmly clenched; the eyes are fixed in their sockets, and have a wild, unnatural expression; the nostrils are expanded; the corners of the mouth are retracted; the countenance has an old, haggard, and withered look; the respiration is laborious and hurried; and the smallest quantity of fluid is unable to descend the fauces and œsophagus. So great, in fact, generally, is the impediment to deglutition that the very sight of water is a source of suffering. The pain is usually very severe, particularly about the jaw, throat, chest, and spine; while the general sensibility of the surface is so excessive that the slightest breath of air is often sufficient to bring on violent spasms.

Fever is seldom present in traumatic tetanus, even when it has reached its height, although the thirst is generally quite considerable; the pulse, which rarely exceeds eighty, eighty-five or ninety in the minute, is soft and regular, except, perhaps, during the violence of the muscular spasms, when it may be considerably agitated, small and feeble; the tongue, at first moist, becomes gradually dry and brownish; the stomach is extremely torpid; the bowels are generally obstinately constipated; the urine is scanty and high-colored; and the skin is hot and bathed with a copious perspiration, which is occasionally very clammy and offensive, especially towards the latter stages of the disease. The mind is usually unimpaired.

Although such is the most common course of the disease, yet more or less irregularity occasionally arises, giving the symptoms somewhat of an anomalous character. Thus, there may be almost a complete absence of pain; the throat may be free from uneasiness; the respiration may be gasping, or performed with a sort of catch; the eyelids may be half closed; the orbicular muscle of the mouth may be firmly contracted over the teeth; and the extremities may remain completely relaxed. The skin is, occasionally, remarkably hot, the

temperature, in some cases, having been found to range as high as 110° of Fahrenheit.

Diagnosis.—The diagnosis of tetanus rarely, if ever, presents any difficulties. In general, the history of the case alone is quite sufficient to determine its real character. The only disease with which it can be confounded is hydrophobia, but the symptoms of the two affections are so very different that none but a most heedless practitioner could possibly commit such an error. The period of latency in hydrophobia is, on an average, not less than a month, while tetanus is usually developed in from four to fourteen days from the infliction of the injury which provokes it. Besides, in rabies there is an absence of locked jaw and of opisthotonos, which constitute such striking features in tetanus.

One of the most valuable diagnostic symptoms of tetanus is the terrible distress in the precordium; it is usually described as of a painful, dragging nature, and is no doubt dependent upon spasmodic contraction of the diaphragm. Coming on early in the disease, it generally continues to its close, and is nearly always attended with opisthotonos, the head and shoulders being drawn, as it were, instinctively backward, to relieve pain and favor the introduction of air into the lungs. In tetanus, the muscular contraction is steady and persistent, though liable to frequent and sudden exacerbations; in hydrophobia it is clonic, occurring paroxysmally, and having distinct intermissions. In tetanus, swallowing is difficult, chiefly by reason of the impossibility of separating the jaws; in rabies, it is dependent upon spasm of the throat and œsophagus; in the former disease, the mind is calm and unaffected; in the latter, it is often powerfully excited, and, at times, even furious.

Prognosis.—The prognosis in traumatic tetanus is extremely unfavorable. In the great majority of cases death occurs from the third to the fifth day; and if we occasionally meet with an instance of recovery, the circumstance is to be regarded only as an exception to a general law of the mortality in this affection. In an experience of thirty-one years, I have seen but two cases where the patient escaped with his life, and then only after a protracted and painful struggle. When the disease has once fairly commenced, the tetanic spasms generally continue to recur, with more or less severity, until they prove fatal. There are no reliable signs which can serve to guide us in regard to the prognosis in this affection. The previous state of the general health, the age of the patient, and the character of the pulse, afford no clue as to the probable issue of the case. The young and the robust fare no better, in this respect, than the old and the infirm. Both alike perish from its attacks. The danger is undoubtedly always, other things being equal, in proportion to the violence and duration of the paroxysms; and it has been found that any tendency to chronicity is generally so much in favor of ultimate recovery; although patients sometimes live for several weeks, and then die from the effects of the malady.

The manner in which death occurs is not well, if at all, understood. In some instances, it is apparently caused by suffocation, from spasm

of the muscles of the larynx; occasionally it results from mere exhaustion, life being worn out by the intensity of the suffering; and in a third class of cases, it may probably be induced by convulsions of the heart, interrupting the passage of the blood to the lungs and brain.

Pathology.—It might reasonably be supposed that a disease which is characterized by so much violence during life, would leave some traces of its existence after death; but to show how erroneous such a conclusion is, it is only necessary to refer to the fact that all the dissections that have hitherto been made of persons dead of this affection have utterly failed to throw any satisfactory light upon its pathology and morbid anatomy. Many statements have been reported with reference to these dissections that are entirely without foundation; in fact, in not a few of the cases, natural or accidental appearances have been confounded with morbid, and lesions have been described which existed only in the imagination of the examiners. From the circumstance that tetanus is essentially a nervous affection, the brain and spinal cord, as well as the nerves emanating from them, and even the great sympathetic, with its plexuses and ganglia, have all been most thoroughly scrutinized in numerous instances, and that, too, by some of the ablest men in the profession, and yet, notwithstanding all this, we are no wiser now in regard to the real lesions of this disease than our forefathers were centuries ago. The whole subject is, in truth, still a mystery. I have myself made several dissections of this kind, and have witnessed others, amounting, perhaps, altogether to eight or ten, without, in a single one, observing any morbid appearances that could justly be ascribed to the effects of the disease. It has been noticed in several instances that the nerves leading from the wound which caused the attack were in a state of inflammation, their substance and neurilemma being congested and discolored.

Of the true pathology of tetanus, then, nothing of a satisfactory nature whatever is known; that it is essentially an affection of the nervous system, or of the nerves of particular muscles, is a circumstance which must be admitted, from the symptoms which characterize it; but in what the peculiar change consists, or to what extent it is carried, are points in the history of the lesion of which we are completely ignorant. I am aware that numerous hypotheses have been framed in explanation of the subject, but the only merit which they possess is their ingenuity; as to any real value which they may have, I have not, I confess, been able to discover it.

Treatment.—The treatment of this obstinate, and, unfortunately, too generally fatal, disease, is altogether of an empirical character. That this should be so is not surprising when we remember how completely ignorant we are of its pathology, and the fact that there is hardly an article of the materia medica, of any reputed efficacy, that has not been employed, either singly, or in various forms and modes of combination, for its relief. Although patients occasionally get well of this disease, and that under circumstances apparently the most desperate, yet, when the practitioner comes to analyze his treatment, in the true spirit of philosophy, he is generally compelled to confess his ignorance as to the share which his remedies may have exerted upon the

fortunate event, and to acknowledge that accident, rather than his own skill, performed the cure. However this may be, it is certain that the disease sometimes yields to the most insignificant measures, or, rather, that it apparently wears itself out; and that, at other times, it resists the best directed efforts of the ablest and most experienced practitioner. The chances, indeed, of effecting any good, when the disease is fairly established, are very slender in any case, however mild. Hence, whatever is done should be done promptly, and with a view rather to a prophylactic result than to a curative one.

It cannot be expected that, in a work of this kind, I should be able to give even an outline of the more important remedies that have been suggested for the cure of this disease; I shall, therefore, content myself with a brief notice of a few of those which general experience has shown to be the most reliable, or most in consonance with the apparent condition of the part and system.

One of the first and most important indications in every case of traumatic tetanus is the removal, if possible, of the exciting cause, which is, of itself, occasionally sufficient to effect a cure. Thus, if any foreign body remain in the wound, or in contact with the living tissues, the surgeon cannot too speedily extract it, especially if there be already some evidence of approaching disease. Sometimes a vicious cicatrice may keep up the tetanic irritation. Many years ago, I attended, in consultation with the late Dr. Buck, of Louisville, a young girl of fourteen, who had locked jaw from having been accidentally hurt, nearly a month previously, in the right cheek by a small splinter. Although the substance was immediately extracted, yet the parts continued to be tender, being, at times, even quite painful, and in less than a week tetanus set in. When I saw the case, free use had already been made, without any material benefit, of anodynes and antispasmodics, along with an occasional purgative, and the cheek had been leeched and repeatedly painted with iodine; the girl was pale and feeble, and had lost her appetite. Upon examining the original site of the injury, I found a small circumscribed spot, exquisitely tender under pressure, and of almost fibro-cartilaginous hardness. This being carefully dissected out, no more paroxysms occurred; and in a few days, with the aid of iron and quinine, wine, and a generous diet, complete recovery ensued.

Amputation of the wounded part has occasionally been performed; and, judging from the statistics that have been published upon the subject, there is reason to believe that the operation has now and then proved successful. Nevertheless, there are, I presume, few surgeons who would be found to be so venturous as to remove a leg or an arm on the approach of such a disease, and none would certainly be foolish enough to attempt the expedient after it is fully established. In the one case, the possibility is that the affection might yield to other and milder means; and, in the other, the disease being no longer one of a local character, but diffused, as it were, through the system, it is difficult to see how amputation, however early performed, could be of any benefit in arresting the morbid action, unless it be upon the principle of substituting a fresh and clean wound for one of an inflamed and

irritable character. An interesting case, bearing directly upon this point, fell under my observation, in 1848, in a patient of Dr. Mattingly, of Bardstown, Kentucky. The man, who was fifty years of age, was a stout, healthy farmer, of a nervo-sanguineous temperament, who, about five weeks previously, had the fore and middle fingers of the right hand, between the second and third joints, severely mashed by the passage of the wheel of a wagon, the phalanges being completely comminuted, and supported merely by a few shreds of integument. A physician residing close by where the accident had happened, removed the injured parts with the scissors, and binding up the ill-formed stumps, sent the man home, a distance of thirty-five miles. The parts soon became excessively painful, and at the expiration of the time above specified, well-marked symptoms of tetanus supervened. Five days after this, while the patient was under the influence of chloroform, I removed the mutilated fingers at the metacarpo-phalangeal joints, the whole hand being at the time exquisitely tender and painful, the tongue coated, the pulse hard and accelerated, and the system irritable from the want of sleep. After the operation, the man had tetanic spasms for several days, but they became gradually lighter, shorter, and less frequent, and, in a few weeks, all symptoms of the disease had entirely disappeared.

How far the recovery in this case was due to the amputation of the affected fingers, it would be difficult to determine; but it is reasonable to suppose that the operation was serviceable by ridding the system of a mass of irritation and disease, which, if it had been permitted to continue in operation, might have proved highly detrimental, if not destructive, to the patient.

In regard to the treatment of the *wound* itself, in tetanus, it cannot be doubted that prompt attention to it is a matter of great moment. Our remedies should generally be of the most soothing character, consisting of warm water-dressing, or emollient cataplasms, with a liberal admixture of laudanum, powdered opium, or, what is better than either, sulphate of morphia. If the parts are girded by inflammatory engorgement, or various kinds of deposits, as will be apt to be the case if the wound is of a punctured character, free incisions must be made, the knife being carried thoroughly through the tissues in every direction. A similar method should be adopted when there is reason for suspecting the lodgement of some foreign body. I cannot approve, in any case, of the practice, at one time so common, and perhaps not yet sufficiently exploded, of pouring irritating fluids into the wound, or of applying escharotics. Such a procedure is only calculated to increase the suffering, and to aggravate the disease.

I have no experience with the section of the *nerves* connected with the injured structures; an operation which is reported to have been several times performed successfully by foreign surgeons. Such a step could only be justified in the case of the smaller nerves, and then, I presume, all the good that would be likely to accrue from it might readily be accomplished by a free division of the affected parts. The section of the larger nerves would be followed by paralysis, which might be permanent.

Attention to the position of the patient's bed is a matter that should not be overlooked in the treatment of this disease. From neglect of this precaution, I have seen several lives lost that might otherwise have been saved. Exposure of the body to a direct draught is often, of itself, sufficient to bring on an attack of tetanus in a susceptible, nervous person; and, after the attack is fairly established, such an occurrence never fails to aggravate the spasms, rendering them both more frequent and violent. The atmosphere of the room should, moreover, be perfectly dry, experience having shown that moisture is extremely prejudicial in all affections of this description.

The most important *internal remedies* are such, undoubtedly, as are of an anodyne and antispasmodic character, of which opium, tartar emetic, aconite, camphor, assafœtida, and Indian hemp occupy the highest rank. They should be administered in large doses, with a view to an immediate and decided impression upon the general system, and should be given either by themselves or in various states and degrees of combination.

The most eligible preparations of *opium* are the acetated tincture and the salts of morphia, particularly the sulphate. Opium in substance is objectionable, on account of its insolubility, the stomach, under such circumstances, being extremely torpid, and unable to act upon it. For the same reason, a much larger quantity of laudanum and morphia is required to produce their specific effect than in ordinary disease. When the patient is young and robust, or when the spasms are violent and obstinate, the anodyne should be combined with tartrate of antimony and potassa, given in doses sufficiently large to relax the system. The latter remedy is sometimes employed by itself, and several cases have come to my knowledge where it seemed to have effected a complete cure. I am satisfied, however, that its efficacy will always be materially enhanced by a judicious combination of it with morphia. In the use of tartar emetic, in this disease, it must not be forgotten that the torpor of the stomach renders it necessary to give it in much larger doses than under ordinary circumstances. If the practitioner were to content himself with the usual quantity, the effects would greatly disappoint him, and the case might, in consequence, proceed rapidly from bad to worse, without receiving any benefit from the remedy.

Aconite is a remedy of great efficacy as a depressant, and may be given as an adjuvant to morphia, or morphia and tartar emetic, in cases of tetanus attended with a robust and plethoric state of the system. It lowers the action of the heart, promotes perspiration, and relieves spasm. Veratrum viride, acting in a similar manner, may be used as a substitute.

Camphor and *assafœtida*, administered in large doses, occasionally aid in controlling the spasms in this disease, but they should never be trusted to alone. Their influence, as antispasmodics, is far inferior to that of morphia and tartar emetic.

Indian hemp, soon after its first introduction into practice, received a large share of attention in the treatment of this disease, especially from the East India practitioners, some of whom were at one time disposed

to regard it as a specific. Subsequent experience, however, has greatly disappointed these expectations, and in this country very little, if any, confidence is placed in the remedy. I certainly have never derived any appreciable benefit from it in the few cases of tetanus in which I have employed it, although the trials in each were very fair. The preparation which is usually given is the extract, in doses varying from one to two grains, repeated every two hours, or even more frequently, the object being to produce and to maintain narcotism.

Great expectations were entertained, on the introduction of *chloroform*, that at length an effectual remedy had been discovered for the cure of tetanus, and there is no article of modern times which has been so generally employed in the management of this disease. Cases successfully treated by it have been reported by different observers; but how far they were really relieved by this agent is a question which has not been decided. It is certain, however, that it has generally signally failed to cure, although it is usually productive of relief to the spasms, which are a source of so much distress to the patient. It should be administered in the form of inhalation, with an abundance of atmospheric air.

Much comfort is often experienced from the use of the *vapor bath* in the treatment of tetanus; the steam should be conveyed, by means of a tube, from the spout of a tea-kettle, or other suitable apparatus, under the bedclothes, and may be advantageously medicated with laudanum, or laudanum and chloroform. The remedy possesses no curative agency.

Bloodletting, and *mercury*, carried to the effect of salivation, were at one time much vaunted, on account of their supposed efficacy in the treatment of tetanus. They have, however, of late years, been entirely abandoned. The patient is certainly reduced sufficiently soon without venesection; and as to mercury, its use has, as stated elsewhere, been followed, in more cases than one, by the very disease which it was intended to cure, the saliva streaming at the time from the mouth in enormous quantities.

When much exhaustion exists, brandy, wine, and a generous diet are indicated, along with quinine, and other corroborants. The profuse and exhausting sweats which so frequently attend the disease are best controlled by aromatic sulphuric acid, and frequent sponging of the surface with a strong solution of alum.

Whatever treatment may be adopted, proper attention should be paid to the bowels, which, as before stated, are generally excessively torpid, and, consequently, difficult to move. When the patient is in a condition to swallow, he may take ten grains of calomel, with double that quantity of jalap, every six hours, until there are free alvine evacuations. If the medicines are slow in their action, their operation may be promoted by the addition of a drop of croton oil, or by means of a stimulating injection, as spirits of turpentine and castor oil. Occasionally, the croton oil may be advantageously rubbed upon the abdomen. Severe purging should be carefully avoided, as, from its irritating and prostrating effects, it cannot fail to aggravate the complaint.

The treatment of tetanus by *counter-irritation* has, I believe, become in great degree obsolete. It was formerly thought, when the disease was supposed to be essentially connected with inflammation of the cerebro-spinal axis, that extensive and rapid vesication of the spine would afford valuable aid in combating the morbid action, and putting a stop to the violent spasms; and examples illustrative of the beneficial effects of this mode of treatment have been published by different observers. The remedy usually selected is either the common blister, caustic potassa, or the actual cautery. The late Dr. Hartshorne, of this city, was in the habit of employing a solution of potassa, in the proportion of one drachm and a half to two fluid ounces of distilled water. It produces a powerful rubefacient effect, and may be applied by means of a cloth mop to a narrow line of skin, from the occiput to the sacrum. If the hot iron be used, it should be applied transcurrently. I have, however, great doubts in regard to the propriety of any measures of this kind, believing that they frequently aggravate the symptoms instead of relieving them.

When the disease is chronic, and the wound still open, but indisposed to heal, the best plan is to divide the parts freely with the knife, so as to relieve them of engorgement, and invite a more salutary action. It is under such circumstances that the *actual cautery* occasionally answers a good purpose. In a case which occurred some years ago, in the practice of Dr. W. D. Stewart, of Indiana, and the particulars of which he has kindly communicated to me, an immediate stop was put to the paroxysms by this procedure, after various other means had been tried, without any benefit, for nearly a fortnight. No spasms took place after the application, and the patient, a lad nine years of age, made a prompt and perfect recovery. The wound which had provoked the attack was a large, lacerated one, occupying the right side of the scalp, and extending down to the bones.

Anodyne and stimulating *liniments* applied along the spine have sometimes appeared to act beneficially, both in moderating the spasms and in eradicating the disease. Chloroform has of late been used a good deal in this manner, and several cases of its successful employment have been reported in the medical journals; among others, a very interesting one, by Dr. Hinkle, of Marietta, Pennsylvania, of a woman who suffered from tetanus consequent upon the bite of an eel. The treatment was conjoined with purgatives and antispasmodics, as cannabis Indica, valerian, and compound sulphuric ether.

Finally, should the patient be so fortunate as to survive the disease, the greatest care must be observed during his convalescence, lest a relapse occur, and destroy him, when he is apparently on the verge of returning health. The clothing should be warm, the diet light, but nutritious, the bowels and secretions duly regulated, and exposure to atmospheric vicissitudes sedulously avoided.

SECT. III.—NEURALGIA.

Neuralgia is an affection of the nerves attended with severe, agonizing pain, often paroxysmal in its character, liable to occur in all parts of the body, and generally dependent upon some local irritation, or upon the joint agency of a local and constitutional cause. As it would be out of place in a work of this kind to treat of neuralgia in general, I shall limit my remarks here chiefly to the disease as it manifests itself in certain nerves, particularly those about the face, where the lesion not unfrequently becomes a subject of surgical interference.

Causes.—The causes of neuralgia are various and of the most opposite character. They are predisposing and exciting. Persons of a nervous, irritable temperament are generally supposed, and I believe correctly, to be more prone to the disease than any other class of individuals. Those who are inclined to be rheumatic also frequently suffer from it. It occurs in both sexes, but in what proportion has not been ascertained. In my own practice, which has been unusually extensive in all kinds of neuralgic affections, there has been a decided preponderance of male patients. This may, however, have been merely accidental, as most writers assert that the disease is more common in women than in men. No age is exempt from its attacks, although it is by far most frequent from the twentieth to the fiftieth year. It occurs in all countries and at all seasons of the year; but is most common in winter and spring in cold northern regions and in districts abounding in malarial exhalations. Cold and damp states of the atmosphere are especially favorable to its production. Like gout and rheumatism, the disease occasionally manifests a hereditary predisposition, and in quite a number of instances I have met with it in several members of the same family.

The exciting causes of neuralgia are of a local and general nature. Among the former, exposure of a nerve to the air, or its compression by some tumor, as an exostosis, or soft growth, is the most common. The most atrocious attacks of this disease are generally witnessed in the branches of the trifacial nerve, in consequence of caries of the teeth, laying open their cavity, and thus allowing the air and other irritating substances to come in contact with the denuded nerve within. Similar effects are often produced by the pressure of a dental exostosis, or by the mere thickening of the periosteum covering the fang of a tooth. Occurrences of a like nature often excite neuralgia in the bones. Sometimes the disease is awakened by the contusion of a nerve, occasioned by a blow, fall, or kick; by the irritation of an old, indurated cicatrice; or by the excitement induced by the presence of a foreign body, as a splinter of wood. In the face, neuralgia has been known to be caused by the lodgement of a piece of dead bone in the nose or antrum. A calculus will occasionally produce the disease in the bladder, worms in the bowels, and the larvæ of insects in the frontal sinus. Neuralgia of the pelvic viscera is often induced by the pressure of a displaced uterus upon the surrounding structures.

A very common exciting cause of neuralgia is exposure to cold while the body is overheated and covered with perspiration. When the predisposition to the disease is very strong, the slightest draught of cold air will often bring on an attack almost instantaneously. Exposure to heat is less injurious, though it is also capable of exciting the disease, especially if it be concentrated for any length of time upon one particular locality, part, or organ.

Attacks of neuralgia are sometimes induced by gastro-intestinal irritation, as the presence of a redundancy of acid, indigestible food, worms, impacted feces, or an overloaded state of the bowels. The disease is not uncommon in dysmenorrhœa and in ulceration of the neck of the uterus, in spinal irritation, and in organic lesion of the brain.

Occasionally the cause is seated in the nerve itself, as when it is inflamed, partially ulcerated, or denuded of its natural coverings. After amputation, the stump often becomes affected with neuralgia in consequence of the extremities of some of the nerves being expanded into neuromatous tumors; and similar effects sometimes supervene upon the division of the nerves in cases of wounds, especially lacerated ones.

Finally, the occurrence of neuralgia, as a consequence of malaria, is familiar to every one. In the southern and southwestern States of the Union, where neuralgia of every form and grade is extremely prevalent, the disease, in the great majority of cases, recognizes no other cause. The attacks, under such circumstances, are generally of a distinctly intermittent type, very similar to those of intermittent fever, recurring once every day or every second day, and, after having continued with great severity for several hours, gradually going off, to reappear about the same period on to-morrow; each paroxysm being, perhaps, ushered in by chilly sensations, and terminating in more or less profuse perspiration.

Symptoms.—The nature of the pain in neuralgia is not always the same. In one case, it is dull, heavy, and aching; in another, acute and extremely violent; in a third, it resembles the pain produced by thrusting needles into the tissues; in a fourth, it is pungent, smarting, or burning; and in a fifth, it is sharp and darting, or like an electric shock, running through the parts with the rapidity of lightning.

The pain, whatever its character may be, is generally attended with more or less soreness and tenderness of the affected parts which sometimes pit on pressure, although they are seldom discolored. Finally, the pain may be concentrated, or diffused; that is, it may be strictly localized, or limited to one particular spot, and that perhaps very small; or it may be extended over the greater portion of a nerve, or even over its entire length.

It is important to bear in mind that the pain often breaks out at a point very remote from the one upon which the impression provoking the attack is made. Thus, supra-orbital neuralgia is often produced by disorder of the stomach, or of the stomach and bowels; a carious tooth has been known to give rise to neuralgia of the hip; and spinal irritation not unfrequently occasions neuralgia of the leg, heel, and foot.

A very singular case has been reported where a severe attack of neuralgia of the left forearm could always be instantly excited by touching the meatus of the right ear.

Neuralgia is sometimes associated with rheumatism, and it is to this form of the disease that the term rheumatico-neuralgic is generally applied by nosologists. The combination is most generally met with in persons of an arthritic predisposition, usually affects the muscles, especially the intercostal and spinal, and is often exceedingly intractable, rendering the patient miserable for life, and wearing him at length out by the constancy of his pains.

Neuralgia often exists simultaneously in different parts of the body, and when once it is fairly established it is easily excited by the most trivial circumstances. Its progress is variable. In many cases it readily yields to treatment, and not unfrequently disappears spontaneously; on the other hand, it is sometimes a most intractable disease, worrying and fretting the patient, undermining his general health, and disqualifying him for business and enjoyment. In its worst forms the suffering is almost constant; whereas, in the milder, there are not unfrequently long intervals of complete, or nearly complete, exemption from pain. When the affection is contracted early in life, and proves rebellious, it is seldom entirely gotten rid of, whatever means may be adopted for its relief.

Pathology.—The pathology of neuralgia is not understood. It has generally been supposed that it consists in a mere exaltation of the sensibility of the nervous tissue, but if this were so it is hardly supposable that it would be so intractable a disease as it often is. The explanation may probably hold good in those cases in which the disorder is very transient, or of malarial origin. But in other and in the greater number of cases, it is probable that there is some degree of inflammation present, either in the nerve-pulp, or in the neurilemma, or in both, as is proved by the fact that the parts supplied by the affected nerves are generally more or less tender, œdematous, and even somewhat discolored; phenomena which are clearly indicative of an engorged and incited state of the capillary vessels with a tendency to effusion. In other cases, again, it may consist in a mere perversion of the nervous fluid, as when a nerve is compressed by interstitial deposits, or by causes acting upon its periphery, thereby interrupting the current across the seat of the obstruction.

Prognosis.—The prognosis of this disease may be gathered from what has been stated in the preceding paragraphs. It seldom proves fatal. Its course is irregular. It may last for months, years, a lifetime, the patient finally dying of some other disease. The most dangerous form is visceral neuralgia, which sometimes causes death by the constancy and violence of the pains.

Treatment.—The treatment of neuralgia must be deduced, in great degree, from the nature of the exciting cause, which should, therefore, always receive prompt attention, removing it where this is practicable, or modifying it where it is not, so as to render it as harmless and inoperative as possible. In neuralgia of the face, for example, it will often be found that the cause of the trouble is a carious tooth, upon

extracting which the pain instantly vanishes. Neuralgia dependent upon the presence of an old, callous cicatrice, can only be successfully relieved by the excision of the offending tissues. Vermifuge medicines are indicated when it is caused by worms; antacids when it is excited by vitiated secretions of the stomach; and purgatives, when it is occasioned by an overloaded state of the bowels. Thus, it will be perceived that no single remedy, or class of remedies, is adapted to all cases; a fact which strongly suggests, in every instance, the importance of a most thorough and critical examination of the state of the part and system, with a view to the institution of a rational therapeutics.

It must not be expected, however, that the disease will always disappear upon the removal of the exciting cause. Generally, indeed, it will, and that very promptly and effectually; but there are cases where it is inclined to linger, with little or no mitigation, for an indefinite period, the affected parts being seemingly unable to recover their natural functions, either because they have become habituated to the morbid action, or because they have experienced some organic change which no treatment can reach.

The treatment of neuralgia is general and local, except when the cause is obviously of a purely local character, when general means may usually be dispensed with. Purgatives, a proper regulation of the diet, and antineuralgic remedies, as they are named, constitute the more important constitutional measures; while embrocations, leeches, vesicants, the endermic use of morphia, and section of the affected nerves comprise the more efficient and reliable topical.

There are few cases of neuralgia which are not benefited by the use of *purgatives;* sometimes, indeed, the disease promptly disappears under a few brisk cathartics. Their exhibition is particularly indicated when there are a coated state of the tongue, disorder of the stomach, a vitiated condition of the secretions, headache, pain and aching in the limbs, or an overloaded state of the bowels. The best articles will be blue mass, colocynth, and jalap, or the compound calomel pill, repeated every other night until there is a decided improvement in the general health. Emetics may often be advantageously exhibited, especially when there is evidence of biliary and gastric derangement. The pain is generally mitigated by their action, and sometimes completely removed the moment they begin to manifest their specific effect.

The *diet* must be plain and simple, easy of digestion, and adapted, in regard to its nutritive qualities, to the exigencies of each particular case. The plethoric will be benefited by abstinence; the pale and anemic, by good living. When the general health is much impaired, tonics, as quinine and iron, a generous diet, wine, brandy, porter, and ale, with exercise in the open air, will be of service. Sometimes a sea voyage, or a residence near the sea shore, is salutary.

There are several articles of the materia medica which may be considered as exerting, in some degree, a specific influence over neuralgic affections, and which have hence received the name of antineuralgic remedies. To this class belong quinine, arsenic, strychnine, aconite, and morphia, along with some other anodynes, and the different preparations of iron.

Quinine, the great antiperiodic in intermittent fever, is entitled to the highest rank in the treatment of neuralgia, particularly in that variety in which the paroxysms observe a regular diurnal relapse, with an interval of entire freedom from suffering. It may be administered by itself or in union with an opiate, and a few efficient doses are almost sure to break up the attack promptly and effectually. In my own practice, I seldom give less than ten grains at a dose, repeated every six or eight hours, until the affection is either vanquished, or the specific effects of the medicine are rendered apparent by the aural and cephalic distress. Some practitioners prefer smaller doses, but experience has shown me that they are less trustworthy, and that, at all events, a much longer time elapses before they put a stop to the disease. Quinine may sometimes be employed with much benefit when the affection is not of malarial origin, but in general its effects are not near so apparent in the former case as in the latter.

In chronic neuralgia, or in acute but obstinate attacks, *arsenious acid* is generally found to be one of our best remedies, given in doses varying from the eighth to the twentieth of a grain, three times a day, in union with an anodyne, or an anodyne and tonic. There are few cases of the disease, however obstinate, that will not be materially benefited by the use of this article, if administered with proper judgment and perseverance. The acid is far preferable, in every respect, as an antiperiodic, to Fowler's solution, being much less liable to cause nausea and anasarca.

With the value of *strychnine*, as an antineuralgic, every practitioner is familiar. I have used it, as such, for many years, and its effects have rarely entirely disappointed my expectations. The dose recommended in the books is much too large. I rarely give more than the twenty-fifth or thirtieth of a grain, and sometimes not even so much as that, thrice in the twenty-four hours. Extract of nux vomica is also employed for the same purpose, but is seldom productive of any decided benefit.

Aconite and *Indian hemp* are valuable articles in the treatment of neuralgia, although their efficacy has, I think, been greatly overrated. They may be exhibited in the form of extract, in doses varying from half a grain to a grain, every six or eight hours, either alone or conjoined with other articles.

The use of *morphia* is absolutely indispensable in the treatment of neuralgic complaints, not so much as a curative agent, as for the purpose of controlling the excessive pain and inducing sleep. There are cases, however, which are radically cured by the persevering exhibition of this remedy, but then it is generally necessary to give it in large doses, and to sustain its action by carefully watching its effects. Protracted narcotism has occasionally vanquished the disease after all other means had failed, even to afford temporary relief. Several examples of this kind have fallen under my own immediate observation, and others have been mentioned to me by professional friends. For ordinary purposes the dose need not exceed a fourth or a third of a grain, and in chronic or subacute cases, I rarely give more than the

tenth, twelfth, or fifteenth of a grain at a time, repeated at suitable intervals.

For many years past I have been in the habit of employing, with very happy effects, in a great variety of cases of neuralgia, a combination of some or all of the above articles, giving them in pill form three or four times in the twenty-four hours. The subjoined will serve as a type of such a formula.[1] It need hardly be added that the effects of the prescription should be carefully watched, as several of the articles are of a potent and even a poisonous character. If the system be anemic, two grains of sulphate of iron or of the valerianate of that salt may be incorporated with each pill. Carbonate of iron I never use, as it has always disappointed my expectations, even when I have administered it in large doses and for a long time, and my experience, in this respect, is, I believe, fully corroborated by the results of the observations of other practitioners. When the attack depends upon the presence of a redundancy of vitiated gastric acid, the solution of valerianate of ammonia will be found a highly efficient remedy, administered in the dose of a drachm every two or three hours until relief is afforded. Iodide of potassium has been much lauded as an antineuralgic; but although I have used it in many cases, yet I cannot recall to my mind a solitary one where it seemed to be really of any material service. If it ever does any good in this disease, it is when it partakes of a syphilitic nature.

When the attack is of a rheumatico-neuralgic type, *colchicum* will be required, and will generally act more kindly and promptly than any other article. My invariable plan, however, is to give it in union with a full dose of morphia, as one grain of the salt with one drachm of the wine of colchicum, every night at bedtime, which will be found to be a much better practice than administering these substances in smaller and more frequently repeated quantities.

The *topical remedies* which particularly claim attention on account of their real or imputed virtues are counter-irritants, leeches, morphia, and the steam of hot water, either simple or medicated.

The only counter-irritants that, in my judgment, are at all admissible, in the treatment of this disease, are blisters, ammonia, and iodine. Setons and issues are out of the question, except in deep-seated, obstinate visceral neuralgia, when the latter occasionally prove beneficial, especially if made with the hot iron, directly over the seat of the pain, and if a free and protracted discharge be maintained. The moxa, formerly so much used, has of late years fallen into disrepute. Blisters are particularly valuable in inflammatory neuralgia; they should be retained until the epidermis is well raised, and they are the more desirable because the raw surface thus made may be advantageously employed for the endermic application of morphia. Temporary

[1] ℞.—Quiniæ sulph., ʒj;
Morphiæ sulph., gr. jss;
Strychniæ, gr. j;
Acid. arseniosi, gr. jss;
Ext. aconiti, gr. xv.
Mix, and make xxx. pills; one to be given three or four times a day.

relief, but nothing more, occasionally follows the use of ammonia in the form of liniment, or of Granville's lotion, frictions with ointment of veratria, and painting the parts with tincture of iodine. Leeching is sometimes useful, by relieving congestion, and thus removing one cause of compression of the nerve-pulp; the operation being performed as near as possible to the seat of the disease.

The endermic application of morphia has been found highly beneficial in neuralgia, chiefly, however, in mitigating the pain. It may, as already stated, be simply sprinkled upon a blistered surface, be inoculated, or, what I greatly prefer, be injected subcutaneously. In the latter case, some care is necessary in regard to the quantity of the morphia used, as it occasionally evinces its narcotic effects in a very rapid and decisive manner. The operation which, I believe, I have been one of the first to perform, is executed with a tight syringe, having a very slender nozzle, which is inserted into a small puncture previously made in the skin of the affected parts, the subcutaneous cellular tissue being torn up with a common probe to make room for the reception of a drachm of solution of morphia, holding in suspension from half a grain to a grain and a half of the salt, according to the exigencies of the case. The operation may be repeated once in the twenty-four hours, or oftener, if it should be deemed necessary. In the ordinary endermic application, the morphia does not penetrate to a sufficient depth; while inoculation is still more uncertain, and is by no means free from pain. I believe that the subcutaneous injection of morphia will be found highly serviceable in many cases, especially when the disease is distinctly localized, and rebellious to other remedies.

Hot applications, particularly moist ones, are generally beneficial in putting a prompt stop to the severity of the pain, especially if they are medicated with laudanum, or some other anodyne preparation. They may be used in the form of cloths wrung out of hot water, and covered over with oiled silk or gutta percha, to prevent evaporation; or in the form of steam conveyed directly to the part by means of a tube connected with a tea-kettle placed over a spirit lamp near the bed.

Section and *excision* of the affected nerve have often been practised for the cure of neuralgia, with results, however, by no means always satisfactory. Indeed, there is reason to believe, from the facts that have been published upon the subject by various surgeons, that both operations have generally proved unsuccessful; in many cases temporary relief ensued, but in nearly all the disease ultimately recurred with its former violence. I have myself performed a number of these operations, sometimes merely cutting the affected nerve across, and at other times excising a considerable portion of it, but the result has nearly always been unsatisfactory. Surgeons have not hesitated to remove sections of some of the larger nervous trunks, as, for example, the sciatic.

In facial neuralgia, where resection of the affected nerve is more frequently practised than elsewhere, the operation has, within the last few years, been pushed, if the expression be allowable, to an extraordinary extent by several American surgeons, Professor Carnochan

having led the way. The results of his cases, three in number, will be found in an interesting paper on the subject in the American Journal of the Medical Sciences for January, 1858. The procedure consisted in exsecting the trunk of the second branch of the fifth pair of nerves, beyond the ganglion of Meckel, on account of severe neuralgia of the face. The portion of nerve removed, in two of the cases, was two inches in length, and in the other an inch and three-quarters. The result in all was most gratifying. Should the success of Dr. Carnochan be equally great in the hands of other surgeons, he will have conferred, by the boldness of his operation, an inestimable boon upon a class of patients heretofore considered as almost beyond the reach of relief.

The operation of exposing the second branch of the fifth pair, as performed by Dr. Carnochan, is severe and complicated, and requires, besides chisels and bone-nippers, two trephines, one three-quarters of an inch in diameter, and the other half an inch; the latter being intended for perforating the posterior wall of the antrum. The patient, being placed under the influence of chloroform, is seated upon a chair, with the head resting against the breast of an assistant, who maintains it firmly in this position. The infra-orbital foramen is then laid bare by two incisions, commencing above, near the inner and outer angles of the eye, at the inferior edge of the orbit, and terminating at a sharp point, about an inch below, opposite the furrow on the lower portion of the ala of the nose, the flap thus formed representing the shape of a V. The lip, being now everted, is next detached from the upper jaw, when it is completely divided, along with the cheek, by a vertical incision, extending from the inferior extremity of the V incision through its free border. By dissecting up the two large flaps thus marked out, turning one outward and the other inward, the whole of the front wall of the antrum, together with the trunk of the infra-orbital nerve, is completely laid bare. The crown of the large trephine is now applied immediately below the foramen, and an irregular disk of bone removed, so as to expose the cavity of the antrum. The lower wall of the infra-orbital canal is cut away with the pliers and chisel, while the posterior wall of the antrum is perforated with the smaller trephine. The trunk of the nerve is then isolated from the other tissues in the spheno-maxillary fossa, and carefully traced beyond the ganglion of Meckel, behind which, close to the round foramen in the sphenoid bone, it is divided from below upwards with a pair of blunt-pointed scissors, curved on the flat. The hemorrhage is slight, and the flow from the branches of the internal maxillary artery, in the spheno-maxillary fossa, is easily controlled by the compressed sponge.

In performing this operation upon the dead subject, I have found it quite easy to obtain a sufficiency of room for exposing the nerve, in its entire length, by carrying a curvilinear incision, from an inch and a quarter to an inch and a half in extent, across the cheek, beginning a short distance below the inner angle of the eye, descending towards the level of the ala of the nose, and terminating a little beyond and below the outer angle of the eye. Whatever plan of incision be

adopted, care must be taken not to inflict any unnecessary injury upon the osseous tissues, or to expose the structures of the orbit too freely.

The inferior branch of the fifth pair of nerves may be exposed by perforating the ramus of the lower jaw about three-quarters of an inch behind the large grinder, five-eighths of an inch above the angle of the bone, and an inch and a quarter below the zygomatic process of the temporal bone. A curvilinear incision, with the convexity downwards, is made over the ramus, about two inches in length, and the flap thus made being dissected up, and held out of the way, a disk of bone, half an inch in diameter, is removed with the trephine. The nerve is then hooked up with a blunt tenaculum, and as much as can easily be got at removed with the scissors. Some hemorrhage necessarily follows the division of the dental artery, but this is usually easily arrested by the ligature or by compression.

The inferior dental nerve, at its exit from the jaw, will be found opposite the first bicuspid tooth, midway between the inferior border of the bone and its alveolar margin, and may be easily exposed by raising a semi-lunar flap of integument, with the convexity looking downwards to the neck. Should it be deemed necessary to follow the nerve into the dental canal, this can be readily done by the use of the trephine.

I do not deem it necessary to give plans and rules for exposing nerves in other parts of the body. Few surgeons, at the present day, will be so rash as to exsect any of the larger trunks of the extremities, and the smaller branches may generally be easily found and divided, or portions of them removed, by attention to the anatomy of the parts concerned.

SECT. IV.—PARALYTIC AFFECTIONS.

1. WASTING PALSY.

A peculiar affection of the muscles, consisting essentially in atrophy and fatty degeneration of their fibres, has recently been described under the name of wasting palsy, from the fact that wasting and loss of power of these structures are its most prominent features. The disease, first accurately delineated by Cruveilhier, has been studied with great care by several European observers, especially Aran, Duchenne, Wachsmûth, Eisenmann, Meryon, and Dr. William Roberts, the latter of whom has embodied all that is known respecting it in an admirable monograph, published at London in 1858. Of the contents of this essay I shall freely avail myself in the ensuing remarks.

Wasting palsy presents itself under two varieties of form, the partial and general; the first, as the name implies, being limited to particular muscles, or sets of muscles; whereas the other involves nearly all the muscles, those of mastication and those of the eyeball, including the elevator of the upper lid, being the only ones that escape its ravages. The involuntary muscles, however, remain altogether untouched, even

in the worst cases and in the most advanced stages of the disease. Hence, the reason why the general health is usually so perfect amidst this wreck of the active agents of locomotion.

Of the causes of atrophy and palsy of the muscles, our information is too limited to permit us to speak positively. If occasionally their development has been clearly traced to the effects of cold, to rheumatism, or to excessive and long-continued fatigue, such as attends various mechanical pursuits, it is equally certain that, in the great majority of instances, no plausible reason can be assigned for their occurrence. In a few instances, the lesion has appeared to have had a syphilitic or strumous origin.

The time of life at which this disease occurs is variable; it has been noticed in young children, and, on the other hand, occasionally in old subjects; but the most obnoxious period would seem to be between twenty-five and thirty-five. Thus, in eighty-eight cases, analyzed by Dr. Roberts, the average period was thirty years and six months. General atrophy is not limited to any particular age, but attacks indiscriminately children, adults, and old persons; whereas the partial form rarely shows itself before puberty and after fifty. Both sexes are liable to it, but males suffer much oftener than females; although it is impossible to offer any correct data in regard to the relative frequency of the occurrence. The lesion has occasionally been observed in several members of the same family, and also in the offspring of persons who had themselves been its victims, thus exhibiting a sort of hereditary tendency.

The muscles that are most liable to suffer in this affection are those of the extremities, especially the upper. The wasting generally begins at one particular part of a limb, from which it gradually extends to another; but now and then cases are met with in which it attacks several points simultaneously. It has been noticed that there is usually a tendency in certain muscles to suffer together, as if they were united by a close fellow feeling; thus it has been found that whenever wasting palsy occurs in the muscles of the hand, it is extremely liable to affect those of the forearm also; a similar disposition has been remarked in reference to the muscles of the shoulder and those of the arm. Moreover, experience has shown that when one limb is invaded its fellow of the opposite side is very apt to share the same fate.

The most important *symptoms* of this disease are wasting of the muscles and loss of contractile power, generally coming on in a slow, gradual, and stealthy manner. In the great majority of cases, indeed, the person is unconscious of the mischief that is taking place, until his attention is accidentally directed to the subject by a failure of the power of one of his limbs, especially the hand and foot. "The tailor discovers," says Dr. Roberts, "that he cannot hold his needle; the shoemaker wonders he cannot thrust his awl; the mason finds his hammer, formerly a plaything in his hand, now too heavy for his utmost strength; the gentleman feels an awkwardness in handling his pen, in pulling out his pocket handkerchief, or in putting on his hat. One man discovered his ailment in thrusting on a horse's collar;

another, a sportsman, in bringing the fowling-piece to his shoulder." The wasting, at first very slight, progressively increases until the affected muscles are rendered perfectly soft and flaccid, and their substance is so much wasted that they are hardly one-fifth of the natural bulk; they are, in fact, completely withered, as if they had been starved, and deprived of all nervous influence. The loss of power is generally in proportion to the wasted condition of the muscles, proceeding gradually from bad to worse, until the parts are entirely disabled and useless, no effort of the will being capable of exciting the slightest action.

Besides the above more prominent symptoms, there are others of a minor and subsidiary character. These are fibrillary tremors, cramps and twitches, pain, and a remarkable susceptibility to cold.

Fibrillary tremors, or convulsive twitchings, are very common, especially in the earlier stages of the complaint; they are dependent upon irregular contraction of individual muscular fibres, and are, consequently, always absent when the disease has reached its full development. They generally occur without the consciousness of the patient, and may usually be readily excited by exposure of the affected parts to a current of cold air or water. Cramps are also very frequent; they come on at various intervals, and often constitute a source of real suffering, especially when they are accompanied with pain, which is present in about one-fourth of the cases. The pain may be slight and wandering, severe and fixed, or sharp and neuralgic, shooting about in different directions with the rapidity of lightning. In some instances it occurs in different parts of the muscular system, more or less remote from the seat of the disease, and is then apparently of a rheumatic character. Wasting palsy causes a remarkable sensibility to cold, especially to a cold, humid atmosphere, so that the patient requires an uncommon amount of clothing to keep himself warm and comfortable. Finally, the galvanic excitability of the muscles regularly diminishes with their decay, but is not wholly annihilated until they have completely lost their primitive structure.

It is remarkable that, amidst all this wear and ruin of the muscular system, the general health should uniformly remain unimpaired, even in the worst forms of the disease. The appetite and sleep are excellent; digestion is well performed; the bowels move with their accustomed regularity; and the functions of the kidneys are perfectly normal. The intellect is clear to the last, and the senses retain their wonted vigor. The only trouble which the patient occasionally experiences is difficulty of respiration, from involvement of the diaphragm.

The *progress* of the disease is generally slow, the muscles steadily decaying, until they are at length completely changed in their character; for months and even years they retain some contractile power, and are even susceptible of restoration. General atrophy is always a gradual affection; it seemingly begins in the partial form of the lesion, and is probably merely an aggravated state of it. When the disease has reached this crisis, the patient may be unable to use any of the muscles, excepting, as already mentioned, those of mastication and those of the eye.

The appearances revealed on *dissection* are highly interesting, and characteristic of the disease. The muscles, as might be expected, are wasted in various degrees; some slightly, others very much, and others, again, so completely as to be hardly recognizable, consisting merely of cellulo-fibrous vestiges, with no distinct trace of the original structure. The color of those that still remain is much faded, being pale red, rose, buff, or yellowish, according to the extent of the atrophy; and in all, or nearly all, there are well-marked evidences of granular and fatty degeneration, the former generally preceding the latter, although occasionally they exist independently of each other. Sometimes these changes are confined to one particular part of a muscle, as one-half or two-thirds of its belly, while the other portion retains its natural hue and consistence. Under the microscope, the striped primitive fibres are observed to have vanished, their place being supplied by granular matter and oil globules, and their investing tunic broken down and disintegrated.

The nervous system has been closely scrutinized in many of the reported cases of wasting palsy, but, thus far, nothing of a very satisfactory nature has been thereby elicited. It appears, however, to be well established that the lesions of the nervous system are of much less frequent occurrence than had been imagined. In some of the cases, indeed, there has been no perceptible change of any kind whatever; in others, there was softening or other disease of the spinal cord, either alone, or in conjunction with atrophy of the roots of the spinal nerves, and of their peripheral branches. In an instance, described by Schneevoogt, the great sympathetic with several of its ganglia was extensively wasted and converted into fatty matter.

In what does this disease essentially consist? It was very natural, before our knowledge of the affection was strengthened by the light of dissection, to refer its origin to lesion of the spinal cord, or of the cerebro-spinal axis, such as softening, or chronic inflammation; and from the fact that traces of this description have been observed in several cases, a number of pathologists have been induced to adopt this view. Others, however, maintain, and, as it seems to me, with a better show of reason, that the primordial cause resides in the peripheral nerves, which, becoming affected in a manner that has not yet been determined, undergo atrophy, or atrophy and fatty degeneration, so as to prevent them from conveying a sufficient amount of nervous fluid to the muscles to which they are distributed, and which thus, in their turn, fall into a similar condition. The principal reasons for this conclusion are, first, that in quite a number of the reported cases of this affection the spinal cord was found to be perfectly intact; and, secondly, that, as has been stated elsewhere, the affected muscles sometimes retain, in certain portions of their extent, their natural color and consistence, which could hardly happen if their degeneration depended upon disorganization of the great nervous centres. It may be assumed, then, that wasting palsy is essentially a local disease, originating in some lesion of the nerves of the muscles, and capable, occasionally, of involving the spinal cord secondarily.

The *prognosis* of this affection is generally unfavorable; the partial

form is occasionally recovered from, the complete never. In the latter case death, which sometimes does not occur under several years, is usually preceded by great difficulty of respiration, in a paroxysm of which the patient suddenly expires. In partial atrophy, the disabled muscles, after having struggled on for many months, perhaps neither sensibly advancing nor receding, gradually awake from their torpor, and ultimately regain some contractile power, though never their full vigor.

The *treatment* of wasting palsy has hitherto been conducted too much upon empirical principles; a fact, however, which is not surprising when we consider the unsettled views that still prevail in regard to its pathology. If we assume that it is essentially a local affection, unconnected with any lesion of the spinal cord, it must be evident that our remedies should be directed mainly to the seat of the disease. This is accordingly what, I think, should be done. If there is any disorder of the general health, no time should be lost in correcting it. If the lesion can be clearly traced to a syphilitic or strumous taint of the system, as it has been in a few of the reported cases, the proper remedies will be iodide of potassium with bichloride of mercury; or, where a tonic effect is required, potassium with iodide of iron. Gentle purgatives will be useful when there is constipation with derangement of the secretions. The diet must be plain, simple, and unirritant.

The best *local remedy*, in the early stage of the disease, is, I am persuaded, a blister sufficiently large to cover the whole of the affected muscles, and retained long enough to produce thorough vesication. If decided improvement do not follow in a week or ten days, the application should be repeated. I have often obtained excellent effects from this remedy, and can therefore strongly recommend it as worthy of trial. The hot douche, immediately followed by the cold, will also be found serviceable, but to prove efficacious it should be aided by frictions with some stimulating embrocation, as spirits of camphor, or alcohol and ammonia. The cold douche alone is objectionable, on account of its depressing tendencies. Shampooing will be found useful, and should be practised several times a day. Galvanism has been highly extolled by Duchenne, Meyer, Gros, and others, and there can be no doubt that it has occasionally rendered good service. The current should be passed rapidly over the disabled muscles, taking care to return to each several times during the same sitting; it should be strong in proportion to the obtuseness of the parts, but be gradually diminished as the sensibility augments, otherwise over-stimulation may occur, and thus do harm instead of good. The application may be repeated at first every twenty-four hours, and afterwards twice a day.

Whatever mode of treatment be adopted, it should be combined with gentle exercise of the affected parts, to recall them, as it were, to a sense of their duty. They should, in fact, be re-educated by a system of careful training; but to do this to advantage, the efforts must be steadily and perseveringly continued for many months, if not for several years. If conducted in this way, I should have great hope of ultimate benefit. For some very judicious remarks on this subject, the

reader is referred to a paper on paralysis by Dr. Batchelder, of New York, who has made this disease an object of particular study.

2. INFANTILE PALSY.

There is a variety of paralysis which may be briefly mentioned in connection with the preceding; occurring in young children, generally during the period of dentition, and which, in point of obstinacy and incurableness, is, if possible, still more deplorable. It may be called infantile palsy. Its attacks are usually sudden and unaccountable. The child goes to bed in the evening, perhaps to all appearance perfectly well; during the night, however, he becomes feverish and restless, and in the morning, on attempting to walk, he is unable to stand or use his legs. The limbs soon lose their round, plump appearance, the muscles are rendered soft and flaccid, the feet trail the floor, and the surface feels cold and numb, though sensibility is seldom entirely destroyed in any case, however extensive.

The seizure is much more common in the lower extremities than in the upper; very often it is confined to one thigh and one leg, but occasionally both limbs suffer, and now and then all four are involved, the child being perfectly helpless, and in the most pitiable condition. The paralysis is generally complete, but cases occur in which the little sufferer is still able to use certain muscles, although not with anything at all like their natural freedom and strength. When the upper extremity is attacked, the deltoid muscle is very liable to be affected, becoming remarkably soft and wasted, so that the patient finds it impossible to raise the arm or lift the smallest weight.

The cause of this variety of palsy is not always very evident; in general, however, it depends upon disease of the spinal cord, or of the cord and its membranes; probably inflammation, followed by effusion of lymph and serum, or softening of the nervous tissue. However this may be, the idea of such an occurrence is countenanced by the suddenness of the attack, the paralysis of all the muscles, not of a portion of them, as in wasting palsy, properly so termed, and by the remarkable obstinacy of the disease, most persons remaining crippled during the rest of their lives. If occasionally a recovery takes place, it is to be viewed rather as a rare exception than as a general occurrence.

The general health is seldom impaired in infantile palsy; the mind acts with its accustomed vigor, and all the bodily functions are well executed. As the child advances in years, all the limbs, excepting the disabled ones, increase in size and strength, but the latter remain stationary, or dwindle away still farther, and thus form a striking contrast with the sound.

The *treatment* of infantile palsy must mainly be directed, in the first instance, to the spinal cord, by whose disease it has been provoked. For this purpose leeching, cupping, rubefacients, and blistering should be employed as soon as possible after the occurrence of the paralysis; and these should be followed, if the case is likely to prove obstinate, by a seton, or, what is preferable, because more efficient, by an issue

with the actual cautery, applied, as nearly as can be, opposite the seat of the lesion, and made to furnish a copious supply of pus. If anything will reach such a case, it will be active and long-continued counter-irritation. Meanwhile, the muscles themselves must be rubbed and shampooed, and placed upon a course of careful training, as advised under the head of wasting palsy. If the general health is suffering, alterants and tonics are prescribed; the child is carried about in the open air, and special attention is paid to the bowels and secretions. As recovery advances, strychnine may be of service; but no benefit will be likely to accrue from its exhibition in the earlier stages of the complaint. Mercury has been strongly recommended in this disease, given in minute doses several times a day for several successive months; but, although such a plan of treatment is extremely plausible, I cannot say that I have ever derived any benefit from it in a large number of cases in which I have employed it.

3. PARTIAL PALSY.

Besides the above forms of palsy there are some others, to which the term partial, transient, or anomalous may be applied, such, for instance, as loss of motion of one side of the face, one eyelid, one side of the tongue, or of the hand, forearm, arm, or shoulder, or even of the entire superior extremity. The subjoined facts will serve as illustrations of its character.

Pressure upon the nerves is liable to be followed by interruption of their functions, at one time temporary, at another permanent. A case recently came under my observation in which a man, aged thirty-five, suffered from partial palsy of the forearm and hand from having rested for two hours with his head upon the limb as he lay asleep upon the floor.

In another case, which came under my notice several years ago, temporary paralysis of the left upper extremity was produced by the arm, thrown across the top of a chair, being compressed by the head while the man was asleep. Pressure of the head of a crutch upon the axillary plexus of nerves will occasionally lead to weakness, numbness, and prickling pain in the arm, hand, and fingers. Recently a youth of fifteen was under my charge on account of paralysis of the arm, consequent upon a fall on the shoulder from a railroad car, two months previously. The limb was instantly deprived of motion and sensation, and so continued up to the time of his visit. The head of the humerus had been thrown slightly forwards against the coracoid process, but it exerted no perceptible pressure upon the brachial plexus of nerves.

Paralysis of one side of the face from injury of the portio dura is occasionally met with; more generally the affection is caused by suppression of the cutaneous perspiration, from exposure to cold and wet; and we now and then meet with instances in which it is occasioned by disease of the petrous portion of the temporal bone. The subjoined case affords a good illustration of a very common form of facial palsy.

David Shepard, aged 18 years, blacksmith, of temperate habits, came

under my treatment, in 1856, for paralysis of the left side of the face. The attack came on suddenly three days previously, without any apparent cause, soon after eating a moderately hearty dinner. He had been subject to frequent and severe paroxysms of headache, preceded by dizziness and vertigo. On the day, however, on which he was seized with palsy he had no suffering of this kind; in fact, he had never felt better. His appetite and sleep have always been good, and his bowels regular. The palsy was characterized by inability to move the muscles of the left side of the face, and to close the eyelids, accompanied with a want of sensibility of the integuments. The tongue, when protruded, inclined to the right side, and was deprived of feeling and taste, a lump of sugar, held in the mouth, making no impression on the affected side of the organ. The general health at the time was excellent.

In the *treatment* of these paralytic affections, special attention must be directed to the improvement of the general health, which is often seriously impaired, by the use of purgatives, alterants, and a proper regulation of the diet. In obstinate cases, a mild mercurial course is sometimes serviceable, especially when the lesion is dependent upon organic disease of the brain, or of the cerebro-spinal axis. The principal local remedies are leeches, blisters, stimulating embrocations, the veratria ointment and the hot and cold douches, followed by dry friction. Occasionally electricity proves beneficial.

CHAPTER V.

DISEASES AND INJURIES OF THE ARTERIES.

SECT. I.—WOUNDS AND HEMORRHAGE.

THERE can be no more terrible and appalling sight to a patient and his friends than hemorrhage from a divided artery, especially when the blood is gushing out in a full and angry torrent, threatening every moment to put an end to existence. There is something indescribably sickening and distressing in such a scene, from which every sensitive mind shrinks with dismay and bewilderment. The horror of the scene is increased a hundred-fold, when we are unable to afford the requisite relief. But the sight of blood is not only disagreeable to the common observer; there are few surgeons, however heroic, or well disciplined, who do not, at times, participate in this feeling. If it were not for the frightful hemorrhage which so frequently attends them, operations would be robbed of nearly all their terror, and few men would shrink from their performance. Fortunately, or unfortunately, however—for it is not easy to determine which—this is not the case; the slightest incision is often followed by profuse bleeding, and in the extirpation of tumors, in the removal of limbs, and in various other proceedings, the patient has reason, in many cases, to congratulate himself if he do not perish from the loss of blood. Some of the more serious accidents, as incised, gunshot, and punctured wounds, often prove instantly fatal from hemorrhage; or, if syncope should, luckily, ensue, and thus temporarily arrest the bleeding, death may occur subsequently, but not less certainly, from the same cause. It is for these reasons that hemorrhage has always been a source of so much anxiety to the surgeon, and that its study has engaged so large a share of his attention from the earliest ages of medical science down to the present time. It is, indeed, impossible for him to be too well acquainted with the subject, or too thoroughly prepared to meet its various, trying, and painful emergencies. The reflection, which must often arise, under such circumstances, that possibly all was not done that might have been done, if greater skill had been exercised, is well calculated to overwhelm the sensitive and conscientious surgeon, and to induce a degree of distress which no one, who has not himself experienced it, can possibly appreciate. I do not envy that man his feelings who, through ignorance, inattention, or indecision, allows his patient to perish from loss of blood when he ought to have saved him.

The characteristics of arterial hemorrhage are, first, the scarlet color of the blood, and, secondly, the peculiar manner in which it issues from

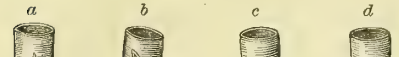
the injured vessel; it spirts out in jets, synchronously with the contraction of the left ventricle, and not in a steady, continuous stream, as when it comes from a vein. This, however, is true only of the larger arteries; for, when the smaller branches are severed, their contents escape very much like those of a vein, only more forcibly, the fluid even then often projecting to a distance of several feet. When one of the principal trunks is divided, the blood is frequently sent with great violence to the top of the ceiling, or far across the room, to the horror and dismay of every one present. The consequences of the hemorrhage vary in different cases, and under different circumstances, being by no means always in proportion to the extent of the injury. When proceeding from a large vessel, or a considerable number of small ones, it may prove fatal in a few seconds, or, at most, in a few minutes. In general, however, the case does not progress in this wise; the patient, after having lost a certain quantity of blood, falls into a state of syncope, whereby the heart's action is temporarily enfeebled, and an opportunity is afforded to the blood to coagulate in the wound, and also around and within the artery, at least for a short distance. By and by, however, the system begins to show signs of reaction; color returns to the face, the extremities become warm, and the pulse reappears at the wrist. With these phenomena recurs the danger of hemorrhage; as the heart's action augments, the blood is propelled with increased vigor to every portion of the body, and presently, the temporary clot being washed away, the wound is reopened nearly, if not quite, to its original extent, thus permitting the blood to flow, if not copiously, at least in sufficient quantity to produce further exhaustion. Again, fainting occurs, a new plug is formed, and for a time life is once more free from immediate danger; but this truce, like the first, is only of short duration; the same scene is re-enacted a second and a third time, until at last, in consequence of the repeated drain, the heart and the brain are no longer capable of supporting each other in the fearful struggle, and the patient sinks completely exhausted.

A person dying from repeated losses of blood, consequent upon the division of a large vessel, presents a fearful picture. His countenance is ghastly pale; his pupils are widely dilated; he pants and sighs for breath; his ideas are vague and confused; he is sick at the stomach and vomits; the extremities are icy cold; and the whole surface is covered with a profuse, clammy perspiration. The thirst is usually intense and unquenchable, the largest quantity of water failing to satisfy the urgent wants of the system; excessive restlessness and jactitation succeed; the patient calls loudly for cold air; paroxysm after paroxysm of swooning recurs; the pulse has, perhaps, already been long absent from the wrist; the eyes assume a glazed and fixed expression; the respiration grows more and more feeble; and death often steals on so imperceptibly as to render it difficult to determine the precise moment of its occurrence. During all this time, whether it embraces only a few minutes or hours, or whether it extends through several days, there is generally an entire absence of pain, the loss of blood operating as an anæsthetic.

If we inquire into the nature of wounds of the arteries, we shall

find that they do not differ, as it respects the weapons with which they are inflicted, from wounds in other tissues. Thus they may be incised, punctured, lacerated, contused, or gunshot, and it would frequently be difficult to determine which class is the worst, or the most certainly and speedily fatal. In regard to their size they present every possible gradation, from the slightest incision to the complete division of the vessel; the wound being either oblique, or transverse in the latter case, but of various shapes when the lesion is partial. Occasionally the wound consists of a mere vertical fissure. The different appearances here alluded to are well displayed in the annexed cut (fig. 160). The extent and character of the wound necessarily exert, as might be supposed, great influence upon the amount and duration of the hemorrhage, and, therefore, demand careful study.

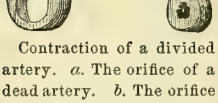
Fig. 160.



Plan of wounded arteries. *a*. A mere longitudinal slit, extending to an oval space. *b*. A similar wound, in an oblique direction, gaping more. *c*. A less wound transverse, with the proportional gaping great. *d*. A transverse wound of the same size as *a* and *b*, causing a very wide hiatus.

When an artery has been completely cut across, there is an instantaneous and impetuous flow of blood, followed immediately by the retraction and contraction of each end of the vessel (fig. 161). The effect of this double action is to diminish the amount and force of the stream, but not to arrest it; instead of this it usually continues until a coagulum has formed upon the orifice of the artery, as well as in the parts immediately around, particularly in the loose cellular tissue constituting its sheath. In this manner a mechanical obstacle is opposed to the effusion of blood, but this would soon be washed away if it were not aided and fortified by the speedy development of a coagulum within the vessel, extending usually as high up as the first large collateral branch. These clots, of which the first bears the name of external, and the other that of internal (fig. 162), are the means which nature employs to put a stop to the hemorrhage; not, however, until, as a general rule, it has proceeded to the extent of causing syncope; a circumstance which is always, as was before intimated, eminently favorable to the coagulation of the blood, and, consequently, also to the formation of the clots now described. But these clots, at this stage of the process, are necessarily very soft, as well as very imperfectly adherent; and hence, in order to guard against their detachment, or, what is tantamount to the same thing, against a recurrence of the hemorrhage, it is imperative that plastic matter should speedily be effused, so that all these parts, clots, vessel, and surrounding structures, may become effectually and permanently soldered together. This accordingly soon happens; for within a few hours after the occurrence of

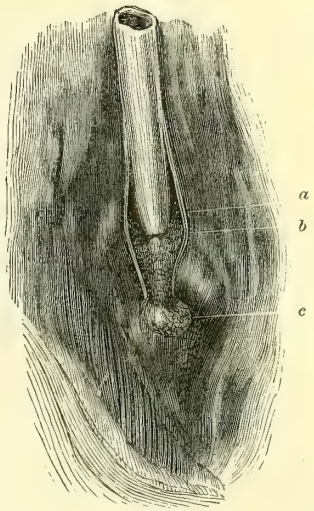
Fig. 161.



Contraction of a divided artery. *a*. The orifice of a dead artery. *b*. The orifice of a living vessel immediately after section.

the injury inflammation is enkindled, both in the divided artery and its sheath, and this being followed by a deposit of lymph, the parts in question are more firmly fixed in their respective situations, every day adding to their security and stability. Meanwhile, a process of organization is instituted, the first step of which is the removal of the serous and coloring matters of the clots, thereby rendering them more solid and pale; vessels now show themselves, some of them being probably of new formation, while others, and perhaps the greater number, are derived from the divided artery and its sheath, as well as from the surrounding structures.

Fig. 162.



Plan of natural hemostatics, in a cut artery. At *a*, the cut end of the arterial tube; conical, by contraction. At *b*, the arterial sheath, vacated by the retracted artery, and occupied by coagulated blood. At *c*, the coagulum projecting from the orifice of the sheath.

The two clots now described are, it will be seen, inseparably blended at the orifice of the divided vessel, and their form and arrangement may not be unaptly compared to a glass stopper, closely fitted into the neck of a decanter. The outer clot is rough and irregular, whereas the internal is perfectly smooth and cylindrical, except its cardiac extremity, which is nearly always conical. The longer the internal coagulum is the less danger is there generally of its premature detachment.

The changes above mentioned as occurring in the two clots are generally the work of time; the gluing process is usually effected rapidly, since its intention is to protect the patient against hemorrhage; but the removal of the serum and coloring matter of the blood, and the conversion of this fluid into solid matter, take place more slowly, and are often not completed under several months. Finally, if the parts be examined at a still later period, it will be found that both clots have entirely disappeared, and that the injured vessel, as high up as the first large collateral branch, has been transformed into a dense, firm, ligamentous cord, similar to that which is observed in the umbilical arteries of the infant.

Such, then, is the process which nature employs for the purpose of arresting the flow of blood from a divided artery. Taking advantage of the exhausted condition of the system consequent upon the injury and loss of blood, she instinctively forms the two clots, having, first of all, drawn away the vessel from the main wound, as well as caused it to diminish its caliber, and then she goes deliberately to work to fasten these clots just precisely where they are most needed for the purpose. The vessel being thus hermetically sealed, she afterwards busies herself still further in getting rid of these plugs, seeing that they are no longer required, and, finally, completes the labor by converting the now obsolete extremity of the artery into an analogous tissue.

These changes, which are both profoundly curious and interesting, bear, it will be perceived, a very close resemblance to those which take place in the callus of a broken bone.

When an artery is divided only partially, whether transversely, obliquely, or longitudinally, an external clot forms, but this is generally so imperfect as to render it altogether incompetent to offer anything like an effectual barrier to the flow of blood. What adds to the difficulty of the case is that the edges of the wound have a constant disposition to gap; and hence, although plastic matter may perhaps be deposited in great abundance, yet it is impossible for the parts to contract permanent and satisfactory adhesions to each other. Whenever the circulation is conducted with any degree of vigor, the blood as it sweeps along washes off the clot, and appears upon the exterior of the wound; and thus the hemorrhage usually continues, paroxysm after paroxysm recurring in more or less rapid succession, until it proves fatal.

Although such is the course which the case usually pursues when an artery is divided only in a part of its diameter, yet it must not be thence inferred that a very small lesion of this kind may not occasionally be susceptible of spontaneous cure. Such an event, which must, however, at best, be extremely rare, may be supposed to be most likely to occur when the wound is oblique or longitudinal; when the opening in the overlying parts is a mere fissure or canal, offering an imperfect outlet to the contents of the vessel; when the system remains for a long time in a prostrate condition; and when, finally, there is a rapid and abundant deposit of plastic matter in the various structures involved in the injury. I have several times seen small shot wounds of the larger arteries, as the subclavian and femoral, healed in this manner; and there is reason to believe that punctures made accidentally in the brachial, in bleeding at the bend of the arm, are occasionally repaired either by the direct adhesion of their edges, or through the intervention of an external clot. In general, however, all such injuries are followed either by hemorrhage, or aneurism, according to the opportunity, or otherwise, which the blood may have to find its way to the surface.

It is well known that contused and lacerated wounds of the arteries bleed much less freely than incised. The reason of this has already been explained in the chapter on wounds, and need not, therefore, be reproduced here.

But, although nature may, and, indeed, sometimes does, arrest the hemorrhage from a divided artery, yet no sensible surgeon would intrust her with such an office, when it is possible to get at the seat of the wound; for it is hardly possible to conceive of a case involving one of the larger trunks where her efforts would be likely to be successful; or where, if ultimately triumphant, the patient would not be brought repeatedly to death's door before she could attain her end. It is only in wounds of the internal arteries, as those of the chest and abdomen, and in the aorta and its larger branches, that we must refrain from direct interference, and limit ourselves to the use of general means calculated to keep down vascular action, especially the liberal

use of anodynes and sedatives, as opium, aconite, and acetate of lead, the application of ice over the seat of the injury, exposure of the body to cold air, and perfect quietude, both of mind and body. All active exertion must for a long time be avoided, in order that, if a cure should take place, the wound may not be suddenly re-opened by the giving way of its edges, in consequence of the imperfect organization of the clots and plasma.

The means employed by art for suppressing hemorrhage are quite numerous, as well as quite diversified in their nature, and will therefore require to be considered somewhat in detail. The most important of these means are: first, the ligature; secondly, compression; thirdly, styptics; and fourthly, torsion. Besides these there are several others of a subordinate character, and upon which, consequently, we shall bestow merely a passing notice.

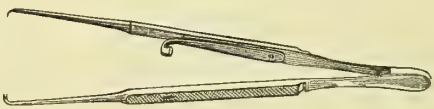
1. *Ligature.*—Ligatures are composed of various materials, as silk, linen, and soft leather. Of these, the first is the most unexceptionable, and almost the only one now employed by experienced surgeons. It should be round, smooth, well twisted, colorless, and so strong as not to break without considerable effort. For the smaller arteries, as the radial, tibial, and temporal, common sewing silk is well adapted; but for the larger trunks, as the femoral, iliac, and carotid, stay silk, which is a much stouter article, is required. Some practitioners are in the habit of using what is called dentist's silk, no matter what may be the size of the vessel, on the ground that it is much stronger in proportion to its thickness than any other similar substance, and, therefore, less liable to excite undue irritation. This thread, which is employed in making fishing lines, is rendered very hard and stiff by means of gum, which, however, is easily removed by boiling it for a few minutes in a slightly alkaline solution. Treated in this way, a piece long enough to tie the iliac artery will hardly weigh the twenty-fifth of a grain. I have not had occasion to use this form of silk, having always had reason to be satisfied with the common article. Linen thread makes an excellent ligature; and in case of emergency, a sensible surgeon will not hesitate to take anything that may happen to come in his way. Whatever substance be employed, it is very important that it should be thoroughly waxed, otherwise it will be difficult, if not impracticable, to draw and tie it with the requisite degree of firmness, to say nothing of the greater tendency of the knot to slip. From eight to ten inches is a good average length for a ligature.

Animal ligatures were first introduced to the notice of the profession by Dr. Physick, early in the present century, and they have ever since been occasionally employed by different practitioners, chiefly American. The late Dr. Jameson, of Baltimore, used them nearly altogether for many years, under the belief, founded upon numerous experiments and clinical observations, that they were decidedly superior to all others, their presence never causing any of the irritation which sometimes follows the use of the ordinary substances. The article to which he gave the preference was soft buckskin leather, which he cut into thin, narrow strings, care being taken not to tie them too firmly, lest they should break, and be prematurely detached. Other practi-

tioners have recommended the fibres of the sinew of the deer. The advantage of the animal ligature is that, besides approaching more nearly to the living tissues than any other material, the ends may be cut off close to the knot; its disadvantage, that it soon becomes disintegrated, from the imbibition of the fluids, thereby rendering it liable to separation before it has accomplished the object for which it was applied. This reason is, I conceive, quite sufficient to induce its rejection from practice; for no conscientious surgeon, it seems to me, would ever subject his patient to such a contingency, especially when he has always at hand so reliable a substance as silk.

The wounded artery may be very conveniently drawn out with a pair of spring forceps (fig. 163), an instrument which, indeed, I gener-

Fig. 163.



The spring artery-forceps.

ally prefer, or with a tenaculum, represented in the adjoining cut (fig. 164). If the vessel be small, it should be seized in its longitudinal axis, but in the horizontal if it be large, since in this way we can more effectually occlude its orifice, and thus prevent the loss of blood. It

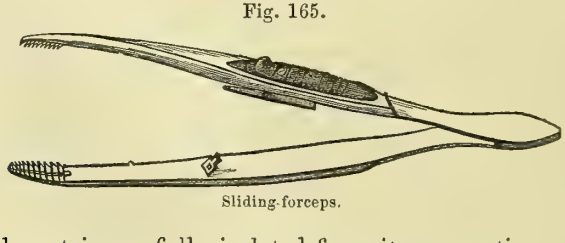
Fig. 164.



Tenaculum.

is for this reason, also, that the forceps are generally to be preferred to the tenaculum; the latter instrument, however, possesses an advantage over the former when the artery is cut off very closely, or when it is desired to include some of the surrounding tissues. When no good assistant is at hand, a pair of artery-forceps, an instrument with broad, serrated extremities, and a movable slide, or catch, to close the blades, will be found convenient (fig. 165). The vessel being

Fig. 165.



Sliding-forceps.

pulled gently out, is carefully isolated from its connections, either with another pair of forceps, the finger, or the knife, or all three together,

as may be most expedient. The propriety of excluding from the ligature the smallest nervous filament, as well as the most insignificant vein, and every particle of muscular tissue, must be obvious to the merest tyro, and need not therefore be expatiated upon here. Such a procedure would not only be productive of pain, but would be liable to be followed by suppurative action, and perhaps materially impede the separation of the thread. The ligature is placed immediately above the point of the instrument, whether this be the forceps or tenaculum, and being tied into a single knot, is drawn with sufficient firmness to divide the inner and middle tunics, if the artery be one of large size, or even of medium caliber, while in the smaller branches, mere apposition of the opposite surfaces will suffice. In executing this part of the operation, the extremities of the ligature are to be drawn round the fore and middle fingers of each hand, while the thumb is extended upon them nearly as far over as the vessel, in order that the force may be exerted in as gentle and equable a manner as possible. Nothing is more unseemly, or more truly abominable, than to see a surgeon or his assistant pull a ligature by fits and jerks, or so violently as to break it in pieces, or, perhaps, lacerate and tear off the artery itself. With a little care and gentleness, a comparatively weak ligature may be thrown round a vessel so as to answer the intention most fully. I deem it my duty to dwell upon this point with some degree of emphasis, because it has happened to me to witness quite an unusual number of these Herculean feats with the ligature, the men often pulling as if they had hold of a rope and piece of wood, instead of a delicate thread and artery.

The ligation is completed by making a double knot, when one end is cut off close to the noose, and the other is afterwards brought out at the nearest angle of the wound. The knot which is thus made is the reef-knot (fig. 166), in which the ends of the thread lie across the artery, in the same manner as they lie across the lips of the wound in the

Fig. 166.

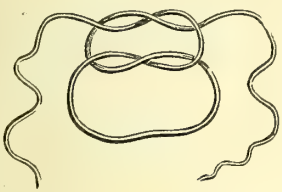
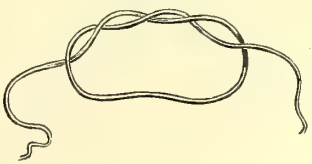


Fig. 167.



ordinary interrupted suture. The surgeon's knot (fig. 167), is no longer used for the purpose, as, from the manner of making it, it is very irregular, and, consequently, ill adapted to the object. In tying very small vessels, we sometimes use only one knot.

The practice of cutting off both ends of the ligature, and of closing the wound over the injured vessel, first suggested towards the latter part of the last century, by Mr. Haire, of England, and afterwards so warmly lauded by Mr. Lawrence and Mr. Hennen, is now, I believe, universally abandoned, and very justly so, on the ground that the

noose, after having performed its duty, creates irritation among the parts with which it lies in contact, leading thus to the development of abscesses, which continue to discharge as long as the foreign substance remains. When the animal ligature is used, this objection does not obtain, as the noose is soon removed by absorption; but then, as was previously observed, this material ought not to be employed, because of its liability to give way before the vessel is completely occluded.

When the arteries are diseased, or abnormally brittle, in consequence of the fibrous, cartilaginous, earthy, or fatty degeneration of their tunics, the ordinary ligature must be dispensed with, and a flat one used in its stead. It may consist of two or more silk threads, carefully waxed, and arranged side by side, or of a piece of soft, narrow braid, and should be drawn so gently around the artery as merely to approximate its serous surfaces. In using the round ligature the object is to divide the inner and middle tunics, as this is most favorable to adhesion; but in this case we aim to preserve their integrity, well knowing that if this be not done the ligature will fall off prematurely, and thus lead to secondary hemorrhage. Cases occur in which the fragility of the arteries is so great as to render them incapable of bearing even this degree of pressure; under such circumstances our only resource is to surround the vessel with a portion of muscular or aponeurotic substance, and to include the mass in a flat ligature. Such a procedure is much more scientific than the practice, formerly recommended, of tying the artery over a roll of adhesive plaster, an operation which cannot fail to be followed by mischief.

In regard to the propriety of drawing the ligature so firmly as to divide the inner and middle tunics, no doubt is any longer entertained by enlightened practitioners. In the time of Scarpa much disputation prevailed respecting this point in the ligation of arteries, it having been alleged by this distinguished surgeon, on the strength of numerous experiments, that a cure could be effected quite as rapidly, and, in the end, more safely, simply by placing the serous surfaces gently in contact with each other. It was supposed that the part, treated in this way, would unite by direct adhesion, and that, consequently, when the ligature finally became detached, there would be much less risk of hemorrhage than when the vessel is lacerated and contused by the ruder method of procedure above described. Plausible as this theory may, at first sight, appear, it is found to be wholly unreliable in practice, for the very reason which induced Scarpa and his followers to advocate its adoption, the ligature being not only a much longer time in separating, but the two ends of the artery being much less effectually occluded. When it is recollected that a certain degree of inflammation is necessary, after this operation, in order to afford the requisite amount of plasma, for gluing the inner clot to the surface of the vessel, it is reasonable to suppose that it would be much more easily induced by a partial division of the inner and middle tunics than by the mere approximation of the opposite sides of the tube; and this is precisely what the general experience of the profession has at length established in relation to the subject.

When a considerable portion of neighboring tissue is obliged to be

included along with the artery, the best instrument for performing the operation is a sharp tenaculum, with an eye near its point, as seen in fig. 168; a curved needle armed with a ligature; or Physick's artery-forceps.

Fig. 168.

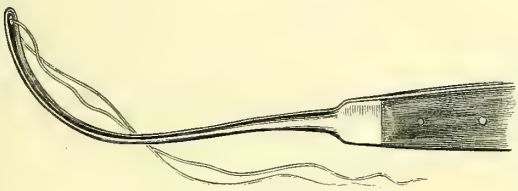


Tenaculum-needle, armed with a ligature.

An artery is sometimes rendered incapable of bearing the ligature in consequence of the softening of its tunics by inflammation. Such an event, which is often exceedingly perplexing, is most liable to happen in cases of secondary hemorrhage after wounds and amputations. The remedy is to isolate the vessel a short distance beyond its diseased limits, and to ligate it there in the usual manner; or, this being impracticable, to tie the diseased part along with more or less of the surrounding tissues; or, this also failing, to cut down upon and secure the main trunk of the artery.

In tying an artery in its continuity, whether as a means of arresting hemorrhage, or of curing disease, the ligature is passed around the vessel by means of an aneurism-needle (fig. 169), a kind of blunt

Fig. 169.



Aneurism-needle, armed with a ligature.

tenaculum, with an eye at the free extremity. Special care must be taken, in performing the operation, to disturb the sheath of the artery as little as possible; this structure is intimately connected with the nutrient vessels, and hence the less it is interfered with the less likely will the artery be to soften, ulcerate, or mortify. There is another point of deep interest connected with this operation, and that is the application of two ligatures, with the section of the vessel between them. This operation, which dates as far back as the time of Ætius, was revived by Mr. Abernethy, through whose influence it became for a while quite popular. It was soon found, however, that it was liable to be followed by secondary hemorrhage, owing chiefly to the injury inflicted during its execution, and it has therefore fallen into complete desuetude.

It was also in the Ætian operation that some of the surgeons of the last century employed what was termed the *reserve ligature*, intended as a ready resource in sudden emergencies. The cord was placed loosely around the artery, to be tied instantly in the event of hemorrhage, from the premature detachment of the original ligature. Experience, however, which is the only true test in such cases, soon showed that the procedure, instead of answering the design for which it had been intended, had a direct tendency to bring about the mischief, from its liability to produce ulceration of the denuded and tortured vessel. Its evils, indeed, are so palpable that it is extremely probable that it will never be revived by any enlightened surgeon.

When an artery is cut completely across in the continuity of a limb, as, for instance, in a sabre wound of the femoral, it is necessary to use two ligatures, one for the cardiac, and the other for the distal extremity of the vessel. The reason of this requirement is that, however securely the cardiac end may be tied, there will inevitably be more or less hemorrhage from the lower, unless this be tied also, in consequence of the activity of the recurrent circulation. Every one who has ever had occasion to ligate the brachial artery at the bend of the arm, on account of injury inflicted upon the vessel in bleeding, must have seen that the hemorrhage was only partially controlled by ligating the upper extremity. The blood, under such circumstances, wells up from the lower part of the artery as water bubbles up from the bottom of a spring; it does not issue in jets, or in a saltatory manner, as when it proceeds from the upper orifice, but lazily, and of a dark color, the bleeding resembling that of a vein rather than that of an artery; and thus the hemorrhage goes on, with little or no interruption, until it is arrested by ligature, or until it proves fatal. The flow may, it is true, be temporarily stopped, during an attack of syncope; but even then seldom perfectly, for the reason, apparently, that the vessel here does not possess the same power of contraction and retraction that it does above, and that, therefore, it is not capable of forming any efficient clot, either external or internal.

The changes which occur in an artery after the application of the ligature are essentially similar to those which occur when the bleeding is arrested spontaneously. The first thing that happens, after such an operation, is the coagulation of the blood within the artery as high up, generally, as the first considerable collateral branch, thus forming what is named the internal clot. The external clot is of course wanting, and this circumstance constitutes the chief point of difference in the two cases. The injured tunics, becoming inflamed, pour out plasma into their own substance, and also upon the free surface of the serous membrane, by which the internal clot becomes firmly and permanently fixed in its situation; the clot next becomes organized, and finally, after an indefinite period, it is completely removed by absorption, the corresponding portion of the artery being converted into a dense, fibro-ligamentous cord.

The changes experienced by the arteries and the blood in their interior, after the application of the ligature, are admirably illustrated in the adjoining sketches. Fig. 170 represents the carotid artery of

a dog, 48 hours after deligation. At *a* the coats are cut across; lymph is effused around, and a clot is formed on each side of the ligature. Fig. 171 exhibits the artery 96 hours after the operation. The ends of the vessel are surrounded by a mass of plasma, through which the ends of the ligature are seen protruding. Fig. 172 represents the vessel on the twelfth day after the deligation. At *a* the artery is cut open, to show its interior; at *b* numerous vessels are seen coming from the exterior, and coursing onwards to enter the clot at *c*.

Fig. 170.

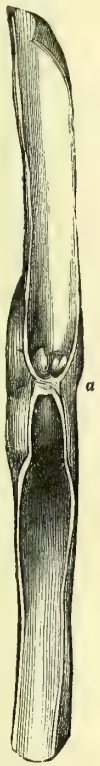


Fig. 171.

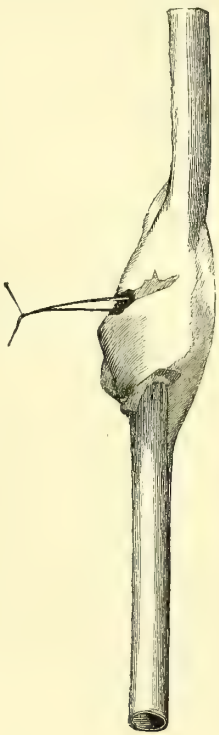


Fig. 172.



The period at which the ligature is detached varies with many circumstances, of which the principal are, the size of the cord and the manner in which it has been tied, the state of the artery, and the amount of the resulting inflammation. A small ligature will, other things being equal, be detached sooner than a large one, and a firm sooner than a loose one; a sound artery will be longer in throwing it off than a diseased one, simply because it has more power of resistance. A ligature upon the brachial artery will generally be detached in about ten days; upon the femoral, in from twelve to fourteen; upon the external iliac, in sixteen; and upon the common iliac, in about twenty-

one days. To this rule there are, of course, many exceptions. I recollect the case of a man in the Louisville Marine Hospital, where, after an amputation of the leg, the ligature was still firmly adherent to the anterior tibial artery at the end of the fourth month. Dr. Lopez, of Mobile, communicated to me, some years ago, the particulars of a case where the separation was not effected before the end of the eleventh month; and Professor Eve met with one where it did not occur until after the thirteenth month. Such cases constitute, of course, exceptions to the general rule, and it may be fairly assumed that they usually depend either upon the faulty manner in which the operation is performed, or upon the presence of an extraordinary quantity of organized plastic matter, interfering mechanically with the detachment of the thread.

When the ligature is indisposed to come away, gentle traction may be made upon it, repeated once in the twenty-four hours; great care, however, must be exercised in performing the operation, otherwise we may not only inflict severe pain upon the patient, but subject him to the risk of secondary hemorrhage.

The process by which the separation of the ligature is effected is worthy of inquiry. It is generally ascribed to ulcerative action, and this is undoubtedly true; but it is equally true that that portion of the artery immediately embraced by the ligature mortifies, and comes away in the form of a slough. When the cord is drawn very tight, the corresponding part of the artery is strangulated, either at once, or, at any rate, in a few hours; but, in general, the process takes place more tardily, and thus affords the two ends of the vessel time to prepare and fortify themselves for the approaching crisis. If we study the whole subject minutely, it will be found to embrace the following acts: first, the strangulation and death of the vessel at the side of the ligature; secondly, ulceration and the consequent separation of a part of the artery, thus producing a gap in its continuity; thirdly, the adhesion of the clot to the inner surface of the vessel, and next its organization; and then, lastly, the absorption of the clot and the transformation of each extremity of the tube into a dense ligamentous cord. In addition to these changes, there is occasionally slight suppuration, the matter usually presenting itself in the form of a little abscess.

The discovery of the use of the ligature is due to Ambrose Paré, in the sixteenth century, prior to whose time surgeons were in the habit of stanching hemorrhage with the actual cautery, hot pitch, and all sorts of stypics, of the most cruel and barbarous nature. "For the good of mankind," says this great man, "and the improvement and honor of surgery, I was inspired by God with this good thought." Paré himself fully appreciated the utility of his invention, but his cotemporaries spared no pains to undervalue it, and to revile and persecute its author, subjecting him to the humiliating office of searching the writings of the ancient fathers of medicine for traces of the use of the ligature as a justification of his practice. Gourmalin, the jealous and malignant President of the College of Physicians of Paris, made himself particularly conspicuous on the occasion, and thus earned an infamous reputation; for the only act by which he is now remembered

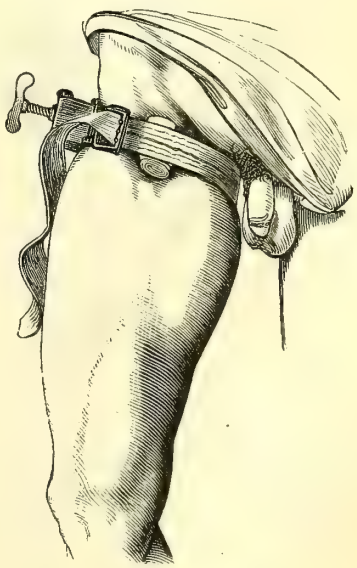
is his bitter and unrelenting persecution of Paré, rendered immortal by his great achievements.

2. *Compression.*—Although the ligature is the most certain means of arresting hemorrhage, yet cases occur to which it is either not at all adapted, or where, from the great depth and narrowness of the wound, it is impracticable to apply it. It is under such circumstances that compression becomes available; an agent which is often hardly less valuable than ligation itself. It is particularly serviceable when the injured vessel lies upon a bone, as in wounds of the brachial and temporal arteries; in wounds, penetrating deep cavities, as the thoracic and abdominal; and, lastly, when the blood issues from a considerable number of small vessels instead of from one large one.

The compression may be temporary or permanent, according to the exigencies of each particular case. When temporary, it is made with the hand, finger, tourniquet, or compress and bandage, and is only kept up until the injured artery can be ligated, or secured in some other effectual way. In permanent compression, the application is continued until the vessel is completely obliterated, whether the time be short or long.

Temporary compression becomes necessary chiefly in cases of sudden emergency, as, for example, when an individual is stabbed in the femoral artery, and the surgeon cannot obtain any persons to assist him in tying the vessel. Under such circumstances an attempt is made to arrest the hemorrhage by means of the tourniquet (fig. 173), or by a graduated compress and bandage; the former being placed directly over the course of the artery from which the bleeding proceeds, or, if this be impracticable, over the main trunk of the limb, and the latter directly over the wound as well as for some distance above it, along the track of the vessel. Whichever method be adopted, it is to be borne in mind that the compression, even if it be maintained only for a few hours, may become a source not only of excessive pain, but also of mortification, and that, therefore, the greatest possible vigilance should be exercised in its employment. When the ordinary tourniquet is not at hand, very efficient compression may generally be made by tying a piece of bandage, a cravat, or a handkerchief loosely round the limb, and then twisting it to the requisite extent by means of a stick, or cane, inserted underneath it. This contrivance, usually called the field-tourniquet, because it was originally employed on the field of battle, may be resorted to with

Fig. 173.



great advantage when a surgeon is obliged to amputate an extremity without having a sufficient number of intelligent assistants, although it labors under the inconvenience of not always concentrating the pressure upon the spot where it is most needed. For this reason the common tourniquet is always to be preferred.

Compression with the hand may often be advantageously employed for the arrest of accidental hemorrhage, until the surgeon has time to apply the ligature; and it is also occasionally resorted to for the purpose of controlling the circulation in the main artery of a limb during amputation. In the upper extremity it is generally applied to the brachial artery, as it courses along the inner border of the flexor muscle; and in the lower, to the femoral artery as this vessel issues beneath Poupart's ligament, and where, consequently, it lies upon the pubic bone. The annexed drawings (fig. 174 and fig. 175), are illustrative of the subject.

In *permanent compression*, the force is applied in one of two ways,

Fig. 174.

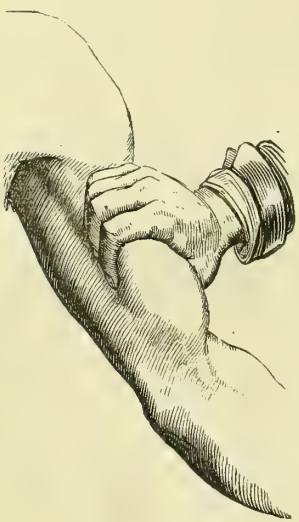
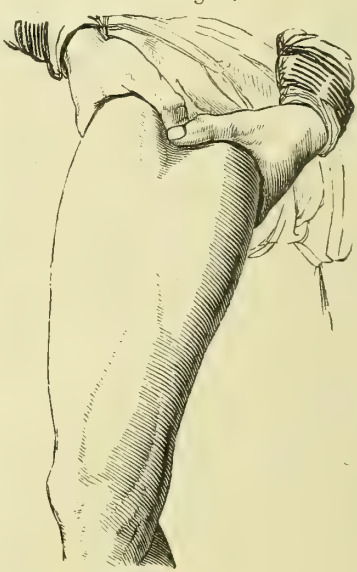


Fig. 175.



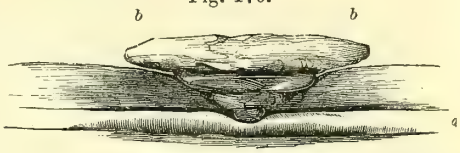
that is, either directly or indirectly. The former method is particularly adapted to the suppression of hemorrhage from deep wounds, as in the lateral operation for stone in the bladder; in wounds of the rectum, whether accidental or wilful; in bleeding of the nose and uterus; in the removal of tumors from the maxillary sinus; in the extraction of teeth; in the extirpation of the eye; and, finally, in wounds of the middle artery of the dura mater, as well as in a number of other injuries and operations which will readily suggest themselves to the mind of the reader.

The great objection to this mode of compression is, first, that it is frequently very difficult to prevent it from becoming deranged, and

secondly, that it is liable to produce severe pain and inflammation, the latter being generally sufficient to cause profuse suppuration. It should, therefore, I conceive, never be employed with a view of arresting hemorrhage from a large artery, or even from a small deep-seated one, if it be at all practicable to apply the ligature, which is, of course, always the most certain and efficient method; but this objection does not obtain when the blood proceeds from a bleeding cavity, or when it oozes from the bottom of a recent wound. Indeed, in such a case, compression must be used at all hazards, for there is often no other way by which the flow can be arrested.

The compression may be made with a graduated compress and roller, or by means of sponge, cotton, wool, patent lint, or any other porous substance. Whatever article be employed, the bleeding surface must be previously freed from coagula, so as to enable us to place the compress directly in contact with the orifices of the vessel (fig. 176). When the blood proceeds from a large artery, the circulation must be controlled, during this part of the proceeding, by means of the finger or tourniquet applied some distance above the wound. The compress is then to be thrust gently but firmly into the breach, the smallest piece being placed directly upon the orifice of the vessel, the next above this, and so on until a sufficient number have been applied, when the operation is completed by bandaging the limb from its distal extremity upwards, care being taken that the compression be made in as equable and uniform a manner as possible. The part is then put at rest, in an elevated position, and action moderated by the use of cold water, anodynes, and other suitable means. The dressings are frequently examined, but not disturbed under four or five days, unless they become displaced, or offensive from the discharges.

Fig. 176.



Plan of a graduated compress. *a*. The artery wounded. *b*, *b*. The graduated compress, arranged so that the apex of the cone is in immediate contact with the arterial orifice, while its mass occupies the general wound, and projects somewhat above the integumental level.

When the hemorrhage proceeds from a wound, as, for example, from that made in the lateral operation of lithotomy, the part must be plugged with a sponge, or piece of patent lint, the hollow of which is filled up with similar matter, or raw cotton, an instrument having been previously introduced through the foreign substance for the purpose of conducting off the urine. A like plan is pursued in bleeding of the rectum. In hemorrhage of the uterus, the vagina is plugged, while in epistaxis both nostrils are closed.

In injuries of the bones, we are sometimes obliged to use a plug of soft wood, as a piece of shingle. In compound fracture of the skull, attended with lesion of the middle meningeal artery, running in an osseous canal, such an expedient is often the only one which can be successfully opposed to the hemorrhage. Bleeding of the nutrient artery of the long bones has sometimes to be stopped in a similar manner.

In some cases the tissues of the part whence the hemorrhage proceeds are employed as the compressing agents. In the operation for hare-lip, for example, the simple approximation of the edges of the fissure by the twisted suture effectually arrests the flow of blood from the coronary artery.

The compression is said to be indirect, or lateral, when it is applied to the track of the injured vessel, and not to its orifice. It is, in general, a more eligible way of arresting hemorrhage, being free from the objections that have been urged against direct compression, with which, however, it is occasionally combined. The best mode of effecting it is to place a long and rather narrow compress over the course of the artery, extending from the neighborhood of the wound some distance above, and to confine it by means of a roller, commencing at the distal portion of the limb, and carried upwards in such a manner as to afford equable support at every point. In other respects, the treatment is to be conducted as in direct compression. This mode of management is often employed, with the happiest effects, in wounds of the brachial artery, at the bend of the arm, caused by venesection.

3. *Styptics.*—Styptics are remedies which arrest hemorrhage by their direct influence upon the blood, and the arteries furnishing it. They comprise a long and varied catalogue of articles, some of which produce merely an astringent effect; others act apparently mechanically, and others, again, are escharotic, destroying both the vessels and the connecting tissues.

Among the less objectionable styptics are alum, sulphate of copper, and the perchloride of iron, especially the first, which I prefer to every other, when such an agent is called for, and which may be used either in strong solution, or in powder, through the medium of patent lint, applied directly to the bleeding surface, previously freed of coagula. Employed in this manner, it generally produces a powerful astringent effect, causing coagulation of the blood, and marked contraction of the vessels, without necessarily leading to suppuration of the affected structures, which is always the case with most of the other articles of this class. Sulphate of copper may be used in the same manner, or in the form of a stick, held firmly for some minutes upon the oozing surface. Creasote possesses none of the styptic properties which were ascribed to it twenty-five years ago, and is now seldom employed with such a view. The *perchloride of iron* is an agent possessing great coagulating powers, but the misfortune is that it creates so much irritation as inevitably to give rise to suppurative inflammation, if not to destruction of the tissues. A similar remark is applicable to the tincture of the chloride of iron. Of matico, I have not made sufficient trial to enable me to form a correct opinion as to its styptic virtues. Judging from what has been said of it by others, we must conclude that it possesses more than ordinary properties of this kind, although further observation is necessary before we can come to a final decision about it.

Within the last two years, the *persulphate of iron* has been highly recommended as a styptic by Mons. Monsel, a pharmaceutist of Bordeaux. It is applied either in substance, or, what is preferable, in strong solution, and possesses the property of instantaneously coagu-

lating the blood, converting it into a very large, dense clot, which is absolutely insoluble, and which continues to increase and harden for several hours afterwards. What adds greatly to the value of this remedy, is the fact that it is entirely free from causticity. It is particularly adapted to hemorrhage of the nose, mouth, and throat, as well as to all other parts of the body where it is impossible to ligate the injured vessels, on account of the great depth at which they are situated. It has also been used for the cure of vascular tumors of the skin and subcutaneous cellular tissue, a solution of the persulphate being injected into them by means of a delicate syringe.

Cold is a powerful styptic, and may be used in various ways. A current of cold air will often put a prompt and effectual stop to capillary hemorrhage, or even to the hemorrhage produced by the division of a small artery, as we see exemplified in operations upon the tonsils and the anus, or ano-rectal region, as well as upon other parts of the body. To prove beneficial, the air must have free access to the part; and it may often be usefully directed by means of the fan, which has the additional advantage of rendering it more cool.

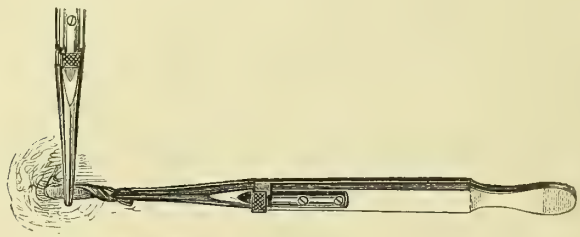
Cold water, refrigerating lotions, pounded ice in bladders, or lumps of ice rolled up in cloths, and applied to the bleeding surface, or in its immediate vicinity, occasionally promptly arrest hemorrhage. These applications are particularly valuable in deep-seated hemorrhage, or in hemorrhage of the internal organs and cavities; they must, however, be used with a certain degree of caution, as their protracted continuance may be followed by injurious reaction, and even by mortification of the part. When the wound is situated externally, but too deeply to render the injured vessels accessible to the ligature, the bleeding may often be promptly and effectually checked by a full stream of iced water, directed upon the part, and maintained steadily for some time, from a large syringe.

The *actual cautery* can hardly be considered as a genuine styptic, although it is usually classed under this head. Its effect is not to constringe the vessels, but to destroy them, by producing an eschar, by which the vessels are, for the time, hermetically sealed. Upon the separation of the slough, however, there is frequently a reproduction of the hemorrhage, especially if the wounded vessels are at all large, owing to the imperfect coagulation of their contents. The cases to which the cautery is mainly applicable are those in which the hemorrhage proceeds from a deep and narrow osseous cavity, and in wounds of the tonsils, uterus, and rectum. The instrument, which may be of a conical form, should be heated to a red heat, and used in such a manner as not to injure the structures around the seat of the affected vessels. When the artery is very diminutive, we may sometimes attain our object with a hot knitting-needle, a wire, or probe.

4. *Torsion.*—Torsion is an old procedure, re-introduced to the notice of the profession by Thierry, Amussat, Velpeau, and others; at one time pointedly condemned, at another immeasurably lauded; opinion being still at variance, although decidedly preponderating against it. In the enthusiasm of the moment much was said and written in its favor; it was even alleged that the larger arteries might

be occluded in this way, and a German surgeon, Dr. Koch, of Munich, actually published some cases of amputation of the thigh, in which he trusted entirely to torsion as a means of preventing hemorrhage. No other practitioner, however, has, I believe, had the hardihood to imitate him, and the operation is now entirely limited to the smallest arterial twigs. The proceeding, which is said to answer most admirably in the inferior animals, serving as a substitute for the ligature, is executed with two pairs of forceps (fig. 177); a small one for drawing out the artery by grasping it horizontally, and a long, stout one provided with

Fig. 177.



Torsion-forceps.

a slide, and serrated blades, for twisting it in its longitudinal axis, from six to eight turns being required, according to the size of the vessel, to lacerate and bruise its tunics so as to intercept and coagulate its contents. I have rarely found torsion of any service even in the smallest arteries.

General Means.—Whatever mode of procedure be adopted for arresting the bleeding, it is an object of primary importance to place the affected part perfectly at *rest*, in an easy and elevated position; the slightest motion might be injurious, especially where no ligature has been used, and should therefore be sedulously guarded against. Repose of the body is equally necessary with that of the part, and it is hardly needful to add that mental tranquillity is also of the greatest moment. Cardiac action, too, must be maintained in the most perfect quietude, as any perturbating agency of this kind cannot fail to favor a return of the hemorrhage and exhaust the system. With a view of inducing this result a full anodyne should be administered early in the disease, the dose being repeated from time to time as occasion may seem to require the soothing and sustaining influence of the remedy. Too much stress cannot be laid upon the use of opiates in the management of arterial hemorrhage, and it is surprising that the remedy is not more generally employed than it seems to be. To allow the heart to go riot, or to move and toss about tremulously, as it is so liable to do after serious loss of blood, while we take every local precaution for the suppression of the bleeding, is assuredly a strange inconsistency, and one altogether irreconcilable with experience and common sense.

The *diet* should be perfectly bland, and just sufficient in quantity to supply the wants of the body. To give less might cause irritability of the system; to give more, over-stimulation. The drink must be cold and acidulated, and not taken so freely as to oppress the sto-

mach, which will be sure to happen if the quantity be not carefully restricted, as the thirst is always urgent after the loss of even a comparatively small portion of blood. Lumps of ice, or pounded ice, held in the mouth, and gradually swallowed, often prove most grateful and beneficial. The air of the apartment must be kept perfectly cool; and, in short, every effort must be made to maintain perfect tranquillity of the circulation.

Secondary Hemorrhage.—Secondary hemorrhage occurs at variable periods; sometimes in a few hours, at other times not under several days or weeks. It is not necessarily preceded by primary hemorrhage, but may come on where the loss of blood in the first instance was perhaps altogether insignificant, and where everything, so far as this event is concerned, gave promise of a most favorable issue. The bleeding often supervenes without any assignable cause; generally suddenly and unexpectedly, and hence it often makes great progress before an opportunity is afforded to arrest it. When proceeding from a large vessel, it may prove fatal in a few minutes, in the same manner as when the bleeding is primary. The scarlet hue of the blood always denotes its source.

The causes under the influence of which secondary hemorrhage may take place are various, but the most important are the following: 1st. A faulty application of the ligature; 2d. A diseased state of the arteries; 3d. Improper traction upon the ligature; 4th. Tight dressing, or too great dependency of the part; 5th. Want of retraction in the vessels; and 6th. A hemorrhagic diathesis. A few remarks under each of these heads will tend to place the subject in a more tangible and comprehensive light.

1. When the ligature is properly applied it simply divides the inner and middle tunics, leaving the outer intact; this too, however, may be cut, not completely, but partially, and therefore the more insidiously, in consequence of the force used in tightening the ligature; or, the deligation may not have been sufficiently firm, the opposite surfaces being only slightly approximated, and the resulting adhesion, therefore, inadequate to effect hermetic closure of the artery on detachment of the cord; or, lastly, the fault may have existed in the ligature itself, on account of the rottenness of its substance, or imperfect tightening of the knot. Whatever the trouble may be, the proper remedy is more efficient ligation.

2. The hemorrhage may arise from *disease* of the artery, either from undue inflammation, or degeneration of its coats, rendering them incapable of supporting the ligature until the clot has contracted firm adhesions. The mode of procedure is obvious; a more healthy portion of the vessel must be sought for, and the ligation effected with more caution; or, this failing, the hemorrhage is arrested by tying the main trunk of the limb, some distance from the seat of injury.

3. Young and inexperienced surgeons sometimes bring on hemorrhage by improper *traction* of the ligature, with a view to the promotion of its separation; forgetting that they may thus tear the artery, or, at all events, break up important adhesions. Such a procedure

cannot, as stated elsewhere, be too severely censured. Re-ligation is obviously the remedy in such a case.

4. *Tight dressing*, causing unequal constriction of the part, or improper dependency, favoring undue afflux of blood, may induce this form of hemorrhage. The result will be most likely to happen when a number of small arteries have been divided, without any attempt having been made to secure them with the ligature. Bleeding having ceased, the dressings are applied, but too firmly, or the part is placed too low, and presently blood begins to appear, issuing, perhaps, with great freedom. The treatment consists in the removal and readjustment of the dressings; with strict attention to posture.

5. Secondary hemorrhage occasionally comes on after operations for the relief of anal, perineal, and other fistules, chronic abscesses, and old ulcers, from an inability of the vessels to *retract* in consequence of the indurated condition of the divided parts. Exposure of the surface to cold air, the application of ice, direct compression, or styptics, constitute the best means of relief. In some cases the actual cautery may be required.

6, and lastly, the cause may be a *hemorrhagic diathesis*, an affection which, as will be stated elsewhere, may occur at any period of life, and which it is often found extremely difficult to control by any mode of treatment, however judiciously conducted.

SECT. II.—SUBCUTANEOUS HEMORRHAGE.

There is a form of arterial hemorrhage to which, from its situation, the term subcutaneous is very properly applicable. It takes place when, from any cause, an artery is laid freely open, and its contents, instead of escaping externally, are extensively extravasated among the surrounding structures. In ordinary hemorrhage, the blood issues directly from the injured vessel, because the outer wound is sufficiently capacious to admit of its free and unrestrained passage, and the consequence, generally, is that it continues until the patient faints, and the bleeding orifice is closed by coagula. In the variety of hemorrhage, however, under consideration, the opening in the integuments is so small as to prevent the blood from appearing externally, and it therefore accumulates beneath the skin, in the subcutaneous cellular tissue, when the artery lies superficially, or in the subcutaneous and intermuscular cellular tissue, when it is deep seated. The accident which usually causes this hemorrhage is a puncture, such as that inflicted in venesection at the bend of the arm, where, in civil practice, it is most commonly met with. It may, however, in consequence of a stab, a bayonet wound, or the laceration occasioned by the sharp end of a broken bone, occur in any part of the body, and is sometimes most profuse, its extent being regulated chiefly by the size of the affected vessel, and the quantity and laxity of the connective substance. In the superior extremity, the extravasated fluid often reaches nearly as high up, on the one hand, as the axilla, and, on the other, as low down as the inferior third of the forearm, extensively separating the muscles

from each other by breaking up their cellular connections, and forming a large, ill-shaped, and confused swelling, attended with violent pain, numbness and œdema of the whole limb, and discoloration of the integuments. More or less pulsation is generally present, especially in the earlier stages of the case, and, upon applying the ear over the site of the wound, a well-marked bruit can frequently be recognized, attended occasionally with a peculiar thrill, or a whirring noise, and a vibratory sensation. It is for these reasons that this affection has usually been described by writers as a variety of aneurism; and, as the blood is always widely extravasated, the prefix diffuse is usually added to that term, as particularly expressive of its more important attributes. Strictly speaking, however, there is no aneurism here; there is simply a subcutaneous accumulation of blood, the consequence of external injury, without any dilatation of the vessel, or degeneration of its tunics; and, although there frequently is, as just stated, more or less concomitant pulsation in the part, yet this does not any more entitle it to be regarded as an aneurism than it would if the effused fluid were so much pus or serum.

The blood which is effused in this accident usually promptly coagulates, and, exerting injurious compression upon the parts with which it is in contact, soon excites severe inflammation, which, especially in persons of an irritable constitution, is liable to assume an erysipelatous character, and to terminate in suppuration, ulceration, and even gangrene. The pain is often intense, depriving the patient of appetite and sleep, and making rapid inroads upon the system. I have witnessed cases where, from the excessive distress thus produced, hectic fever soon came on, and life was placed in imminent peril.

The *treatment* of this lesion is precisely similar to that which is necessary when there is an open wound; that is, the artery must be secured promptly and at all hazard, and the coagulated blood thoroughly evacuated. The operation is often one of great embarrassment, owing to the confused and displaced condition of the parts, and the difficulty which is sometimes experienced in finding the injured vessel, which is not unfrequently lost in the midst of the coagulated blood. A large incision is generally required, and two ligatures must be applied, one above and the other below the wound in the vessel, precisely as in ordinary cases, the object being to prevent hemorrhage by the recurrent circulation. As a preliminary step, the brachial artery is compressed in the middle of the arm by the finger or tourniquet, and after the operation is over, the limb is wrapped up in warm water-dressing, medicated with laudanum and acetate of lead, or laudanum and alcohol, to favor the reduction of inflammation.

SECT. III.—COLLATERAL CIRCULATION.

Among the more interesting phenomena that occur after the deligation of the larger arteries, not the least curious and important is the manner in which the circulation is carried on and maintained in the structures beyond the seat of the ligature. A long time elapsed

after the discovery of the ligature before surgeons could be induced to believe that such an operation could be performed in the continuity of a limb without endangering the parts below by gangrene, in consequence of the sudden abstraction of their accustomed supply of blood. Chance gradually led to the correction of this apprehension, which, however, is not without some foundation, as is proved by the fact that the procedure is occasionally followed, even at the present day, in the hands of the most scientific surgeons, by loss of limb and life. Cases had been observed, from time to time, of the obliteration of the largest arterial trunks by fibrinous concretions, and yet it was perfectly certain that the structures in the distal portions of the extremity had retained their normal growth, no difference being discoverable between them and those of the opposite side. Such a result, it was obvious, could only have been brought about by an enlargement of the collateral vessels, thus enabling them to keep up the normal supply of blood, after the obstruction of the main artery. A number of instances had been noticed of complete closure of the aorta, both in its thoracic and abdominal divisions, without any apparent detriment of any kind, either proximate or remote. These facts, the fruits of the cultivation of morbid anatomy, were eminently suggestive, and we accordingly find that they gradually paved the way for some of the most daring feats in surgery. The original trials with the ligature upon the principal arteries in the continuity of the limbs were highly gratifying, as tending to show that, although the distal structures were temporarily deprived of their accustomed supply of blood, yet this occurrence did not sufficiently interfere with their vitality to cause gangrene, the circulation being speedily re-established through the collateral routes. The process employed by nature in effecting this object has been demonstrated, in repeated instances, by dissection of the parts at variable periods after they had been subjected to operation.

The moment a large artery, as, for example, the femoral, is tied, the blood is obliged to seek new channels for its transmission to the distal portion of the limb. For this purpose it passes on in every direction, entering every vessel, both large and small, into which it can find access. This, however, does not occur all at once, but gradually; for as the arteries which are to carry on this collateral circulation, as this arrangement is termed, are comparatively small, some time is necessary to prepare them for the reception and accommodation of the increased flow of blood. In fact, they are compelled to submit to a species of preliminary dilatation, their tonicity being such as rather to resent its encroachment than to yield to its effects. This is the case both with the branches that are detached from the sides of the vessel above the seat of the ligature and with the capillaries of the various tissues entering into the composition of the limb, which, immediately after such an event, always play an important part in maintaining the distal circulation. Hence, for some time after the operation, the quantity of blood below the point of obstruction is necessarily considerably less than in the normal state, as is demonstrated by the cold and pallid state of the integuments, the defective sensibility, and the loss of muscular power, which is occasionally so great as to deprive the

patient of motion in the affected member. The diminution of temperature is liable to a good deal of variation, but in general it amounts to several degrees, and hence the surgeon is often obliged to employ artificial heat. Gradually, however, as the circulation increases in vigor, the temperature returns to the natural standard, and in many cases even exceeds it, owing to the enlargement and inordinate activity of the cutaneous capillaries, although such an occurrence is usually of short duration.

An instance occasionally occurs in which there is either no change of temperature at all from this cause, or where it is so very slight as to be hardly perceptible. Such a phenomenon is most apt to happen in old aneurisms, where, owing to the obstruction in the artery connected with the tumor, the anastomosing vessels have had time to become enlarged prior to the application of the ligature, so that the operation exerts little, if any influence, upon the circulation in the distal portion of the limb, as it necessarily must in recent cases of that disease, and also in wounds of the arteries, in which no such opportunity is afforded for an increase in the size of the collateral channels.

Coincident with this effort on the part of the affected structures to establish the collateral circulation, there is generally a feeling of uneasiness, if not of actual pain, of a burning or tingling character, obviously occasioned by the compression which the enlarged and distended vessels exert upon the neighboring nerves. Usually, however, this effect is of short duration, as the nerves soon accommodate themselves to their new relations. After some time, the parts gradually recover their natural functions, all disagreeable sensations vanish, the muscles increase in vigor, and the process of nutrition proceeds apparently as well as it did prior to the deligation of the vessel.

Although such is the ordinary course of events after the main artery of a limb has been tied, yet important exceptions are occasionally met with. Thus, it now and then happens that the circulation remains extremely languid for an unusual length of time, perhaps for a number of days, if not several weeks, the anastomosing branches being seemingly incapable of enlarging to a sufficient extent to convey an adequate supply of blood to the affected structures; the extremity is, consequently, cold, heavy, numb, and of a reddish or purplish hue, from passive congestion of the capillaries, and is moved with pain and difficulty. A struggle is evidently going on between nature and disease, in which the latter but too often comes off victoriously; the limb either falling into gangrene without the occurrence of reaction, or, reaction taking place, it is overpowered by the resulting inflammation. Finally, cases occur, although, fortunately, very unfrequently, in which the parts remain permanently weak and crippled; the muscles are soft and flaccid, the adipose tissue is absorbed, and the integuments are habitually cold and congested; the circulation having never attained the normal standard after the operation.

It is worthy of notice that gangrene, from defective circulation, is much less liable to occur after the ligation of an artery, in the continuity of a limb, in wounds than in aneurism. This fact, at all events, is clearly deducible from the statistical tables of Dr. Norris, from which

it appears that in seventeen cases in which the femoral artery was secured on account of recent injuries and different tumors, gangrene did not occur in a single one, whereas this result was witnessed in thirty-one cases out of two hundred and four in which the operation was performed for the cure of aneurism. May not the cause of this disparity be the compression which the tumor in this disease exerts upon the neighboring structures, thereby obstructing the circulation in the distal portion of the limb, and at the same time seriously embarrassing the functions of the nerves? I presume that this result is very materially influenced by the nature of the wound, necessitating the deligation of the artery. If, for example, the parts are extensively divided transversely, or very obliquely, so as to destroy the continuity of a large number of its more important branches in the immediate vicinity of the wound, gangrene will be much more likely to occur than under opposite circumstances, in which the neighboring vessels being but little injured, the blood will easily find its way into the distal structures, thus affording them the requisite supply not only for the preservation of their vitality but also for the maintenance of their nutrition.

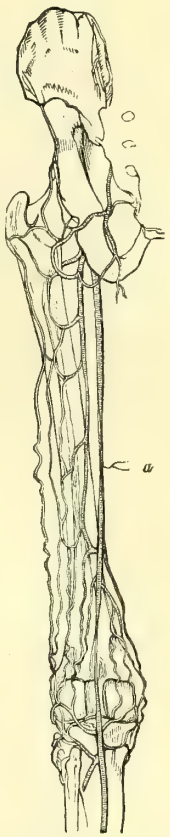
Although the capillaries are greatly instrumental in carrying on the circulation in the distal portion of the limb, immediately after the deligation of its main artery, yet their agency is really merely of a temporary character, ceasing with the establishment of the collateral circulation, properly so called, as developed by the larger arterial branches in the vicinity of the ligature. These arterial branches are occasionally given off by the affected artery itself, but most commonly they arise from some neighboring trunks. Thus, when the superficial femoral is tied high up, the collateral circulation is established through the agency mainly of the profunda, whose branches inosculate with the articular, which are offsets of the popliteal. In ligation of the brachial, the blood is transmitted to the forearm and hand by the communications naturally existing between the anastomotic and profunda arteries, branches of the affected vessel, and the recurrent branches of the radial and ulnar, in which the brachial terminates. In ligation, on the contrary, of the common carotid, the circulation of the corresponding side of the head and neck is kept up mainly by the communications between the occipital and deep cervical arteries.

It has been noticed, as an interesting physiological fact, that the anastomotic arteries, before they unite with each other, separate into several branches, often as many as three or four, so as to form a kind of circle, as if nature were particularly anxious to guard against any risk that might otherwise occur to the collateral circulation from accident or disease.

However established, the collateral vessels gradually augment in size, until, at length, their united capacity is fully equal to that of the obliterated trunk (fig. 178), whatever may have been its size. There are, of course, as already stated, exceptions, but they are, probably, much less frequent than is generally imagined. A highly interesting case, beautifully illustrative of the present topic, occurred, some years ago, in the practice of Dr. Frank West, of this city, by whom the particulars have been published in the second volume of the Transactions

of the College of Physicians of Philadelphia. The patient, who was a stout, athletic man, aged thirty-two, died suddenly from rupture of an aneurism of the thoracic aorta. On dissection, it was found that this vessel was entirely obliterated, just beyond the remains of the arterial duct, its coats having a constricted appearance, as if they had been embraced by a tightly-drawn ligature. Everywhere else, excepting at the place of aneurism, the aorta was perfectly natural. All the branches of the subclavian arteries were much increased in size; and the internal mammary and epigastric, which served to keep up the connection of the circulation above and below the seat of the stricture, were fully as large as the external iliac, the former having coursed along the walls of the chest in a very tortuous manner. As no tumor was discovered at the seat of the obliteration, Dr. West was unable to determine whether the disease was the result of accident or of a congenital vice. Be this as it may, the case affords an admirable illustration of the manner in which the collateral circulation is carried on after the interruption of the column of blood in such an immense vessel as the aorta.

Fig. 178.



Collateral circulation shown in the thigh. At *a*, the femoral artery has been obliterated by ligature.

The collateral circulation is not developed with equal facility at all periods of life, or under all circumstances; it is most readily established in young subjects, in whom the arteries, besides being very active, enjoy a high degree of elasticity and pliancy, well adapted for such an enterprise. In old persons, on the contrary, the functional activity of these vessels is often much impaired, many of the small branches are obliterated, and their coats are extremely liable to earthy deposits, converting them into firm, rigid tubes, ill qualified for the discharge of their duties. In many cases, loss of blood, ill-health, or defective vital power, seriously interferes with the development of the collateral circulation.

Finally, the collateral circulation may be too active. Such an event is not likely to happen when the main artery of a limb is tied on account of hemorrhage from a wound, but its occurrence is by no means uncommon in aneurism, and is then apt to be followed by a return of the circulation and pulsation in the tumor, in consequence of the activity of the anastomosing branches, which thus continue to feed the sac, and perhaps effectually oppose the cure.

SECT. IV.—HEMORRHAGIC DIATHESIS.

The hemorrhagic diathesis is that peculiar state of the system in which, generally from some slight traumatic cause, there is a strong tendency to an inordinate discharge of blood. Persons who are laboring under this constitutional infirmity, are often placed in imminent jeopardy by the most insignificant scratch, puncture, or incision, which, under ordinary circumstances, would hardly emit more than a few drops of blood. Occasionally the cause of the bleeding is the accidental rupture of some of the smaller vessels of the mucous membrane, as, for example, that of the nose, lungs, rectum, or urinary bladder. The extraction of a tooth is sometimes followed by this form of hemorrhage. I recollect one case in which death was produced in this way; and another where the bleeding, having persisted for nearly four days, gave rise to severe exhaustion and great apprehension respecting the safety of the patient. Many years ago I lost a child, six months old, from hemorrhage consequent upon lancing the gums over the upper central incisors, which were nearly ready to protrude; he was affected at the time with cholera, but previously to that he had always been remarkably healthy. The bleeding commenced in less than twenty-four hours after the operation, and continued, despite all that could be done for his relief, until the end of the fifth day, when he died completely exhausted. A short time before he expired, hemorrhagic spots appeared on different parts of the body, and blood began to be discharged from the bowels. In 1857, I operated for strabismus upon a young gentleman who possessed this peculiarity; the division of the internal straight muscle was followed by an oozing of blood, which continued, nearly constantly, for the greater part of a fortnight, when, the wound being almost healed, the bleeding ceased.

The blood in this variety of hemorrhage oozes from the injured part, as water oozes from a sponge; it does not spirt out in jets, as when it comes from an artery, or in a continuous stream, as when it proceeds from a vein. Its color is neither scarlet nor black, but intermediate between the two; it generally partially coagulates when it is received into a vessel, but rarely does so while it is in contact with the living surface.

This affection has occasionally been noticed in several members of the same family. In a remarkable case, reported by the late Dr. John A. Swett, of New York, it existed in all the children, eighteen in number. All except one had died from this cause, and he was suffering under profuse hemorrhage of the nose and rectum. Twelve sisters died before the age of twelve from bleeding of the uterus; two of the brothers had fallen victims to traumatic hemorrhage.

Mr. Wardrop gives a curious case in which this peculiarity was hereditary. The patient was a boy, in whom the hemorrhagic tendency displayed itself when he was scarcely two months old. On several occasions, he nearly lost his life from the most insignificant wounds. His brother, twenty-two years old, was frequently afflicted in a similar way. Of his five uncles, not one was free from this predisposition

three died from the division of the frænum of the tongue, and one from the extraction of a tooth; while the other, although he suffered from the same disease, finally died from some other cause. His two aunts exhibited no signs of this diathesis; but, what is singular, all the male branches of their families, excepting one, were thus affected.

A still more remarkable case has been reported by Dr. Hughes, of Kentucky. The predisposition here was associated with a rheumatic diathesis, and was satisfactorily traced as far back as five generations. It was confined exclusively to the male branches of the different families; but the females, nevertheless, invariably transmitted it to their offspring. Many of the individuals died in infancy and childhood, death resulting, in some, from the cut of the lancet; in some, from accidental wounds; in some, from internal hemorrhage; and in two, simply from the application of blisters, the vesicles being filled with blood instead of water.

Of the immediate *causes* of the hemorrhagic diathesis, we are completely ignorant. Whatever they may be, it is evident that they are deeply engrafted in the constitution, as is proved by the fact, first, that it generally shows itself at a very early age; secondly, that it often occurs in several members of the same family; and thirdly, that it is sometimes hereditary. The immediate causes seem to be two: first, a want of coagulating power in the fibrin of the blood; and, secondly, an imperfectly organized state of the capillary vessels, which are the immediate seat of the hemorrhage.

If one were inclined to speculate in regard to the cause of this defective coagulating property of the blood, it would be easy to find it in an insufficient supply of nervous power, upon the presence of which, as is well known, the vitality of this fluid essentially depends. Whatever has the effect of weakening this influence, proportionably interferes with the concretion of the blood, both as it circulates through the body and after its removal by venesection. The fact that the blood remains fluid in those who are suddenly destroyed by lightning, has long been familiar to practitioners. Similar phenomena occur when a person is killed by a blow on the stomach, by prussic acid, the poison of the rattlesnake, excessive bodily fatigue, or violent agitation of the mind. Certain diseases, as Asiatic cholera, plague, and malignant fevers, produce the same effect. It has been satisfactorily ascertained that, when the pneumogastric nerves are tied in animals, the blood loses its property of coagulating, the coloring matter at the same time separating from the fibrin, and assuming an unusually black color.

But in all these cases, the loss of nervous power is sudden, and hence it is easy to perceive how it should influence the coagulation of the blood. In persons laboring under the hemorrhagic diathesis, on the contrary, the blood is generally habitually indisposed to coagulate, so that they are more or less liable to bleeding whenever they experience any injury, however slight. The analogy, then, between these different states of the system is exceedingly remote, and can, indeed, hardly be said to be established. Its force, moreover, is weakened by the fact that the subjects of the hemorrhagic diathesis generally enjoy as good health, and as much vigor of constitution, as those who are free

from it. To say that such persons are constantly laboring under a want of nervous fluid, is to affirm that they are imperfectly organized, and deficient in genuine nerve-power; circumstances which, if true, remain to be proved. I am not aware that any experiments have been made tending to show that the blood in the hemorrhagic diathesis is deficient in fibrin; such observations might be easily instituted, and they could hardly fail to throw important light upon the pathology of this peculiar affection.

The other appreciable element in the pathology of the hemorrhagic diathesis, is the want of contractility on the part of the capillary vessels. It has been supposed that this is due to the absence of the middle tunic of these vessels; but such a deficiency must necessarily be a matter of inference rather than of observation, and I am not aware that any one, whose opinion is entitled to much weight, any longer holds such a view. That there is a want of tone in the capillaries is certain, but how this is brought about, or in what it consists, is still a subject of conjecture.

The *prognosis* of this form of hemorrhage is generally not very favorable, particularly so when it is of a hereditary nature, in which event, it is extremely liable to prove fatal. In the case related by Swett, seventeen out of eighteen members of a family thus affected had perished, and the survivor himself had repeatedly suffered from severe bleeding in different parts of the body. In the case of Hughes, in which the diathesis prevailed in not less than five generations, nearly every individual died from hemorrhage; many of them in infancy and childhood.

In the *treatment* of the hemorrhagic diathesis, two indications are presented: the first is to promote the coagulability of the blood; the second, to increase the contractile power of the capillary vessels. In addition to these, it will be necessary, if a good deal of blood has already been lost when the surgeon is called to the case, to support the system by tonics and a nutritious diet.

The first of these objects is best fulfilled by the judicious use of acetate of lead and opium, the former of which seems to exert a direct influence upon the coagulability of the blood, while the latter affords important aid in controlling the action of the heart, generally rendered turbulent by the bleeding and the patient's mental anxiety. The dose of the salt should vary from half a grain to a grain and a half, every two, three, or four hours, according to the tolerance of the stomach and the amount of hemorrhage, and should contain at least one grain of opium, or its equivalent of acetate of morphia. If heat and dryness of skin exist, a small quantity of antimony or ipecacuanha may be added to each dose, to produce perspiration. Severe depression, however, must be vigilantly guarded against. If there be much cardiac action, tincture of aconite or veratrum viride should be given, its effects upon the system being carefully watched. Whatever else be done, it is of paramount importance, in every case, to control and quiet the heart's action.

To increase the contractility of the capillary vessels, which is the next indication, provided this has not been effected by the acetate of lead, recourse must be had to tonics and nutritious diet. Of the former,

one of the best articles, according to my observation, is the tannate of iron, either alone or in union with quinine, in doses varying from two to five grains, administered every two, three, or four hours, in pill form. The diet should be light, non-stimulant, and nourishing, and moderate use should be made of milk punch, toddy, or wine. In general, these measures will be well borne, having a tendency rather to quiet the action of the heart than to occasion undue excitement. Tranquillity of mind and body are of paramount importance, and must, therefore, not be neglected.

Purgative medicines will usually prove highly serviceable, both as evacuants, as counter-irritants, and as restorers of the secretions, which are nearly always much disordered in this variety of hemorrhage. Estimating these remedies at their real value, I am satisfied that they are entitled to the highest rank in the treatment of this affection; they must not, however, be carried too far, otherwise they may induce irritability of the heart, and thus do harm instead of good. If the patient be plethoric, he may take sulphate of magnesia, which is particularly appropriate under such circumstances, on account of its chemical action upon the blood; or, what will generally be better, especially when there is marked derangement of the secretions, a full dose of calomel and compound extract of colocynth.

If the bleeding be attended with fever, or with heat and dryness of the surface, recourse must be had to diaphoretics, as antimony and morphia, or the neutral mixture, aided by tepid ablutions. Coldness of the extremities must be relieved by hot mustard baths.

It need hardly be added, that the sooner these constitutional measures are carried into effect, the more likely will they be to prove efficient in arresting the hemorrhage; the longer the bleeding has lasted, or the greater the amount of blood that has been lost, the more difficult will it be to arrest the disease and prevent its downward tendency. Moreover, a proper plan of treatment having been selected, it should be diligently persisted in until it is capable of exerting its beneficial influence, and not be constantly varied, as is so often the case in the hands of the timid and inexperienced; it being never forgotten that some time must necessarily elapse, in such a case, before the system can be favorably impressed by any measures, however judicious or energetic.

The topical treatment is often of paramount importance. When the hemorrhage proceeds from a wound, the affected structures should, if possible, be included in a firm ligature. For this purpose, the twisted suture may be used; or, if this be impracticable, systematic compression is made by means of a graduated compress and roller, the surface of the wound having previously been dried, so as to allow the lint to come directly in contact with the bleeding orifices of the divided vessels. The efficacy of the compression will sometimes be increased by the use of a piece of tinder, placed upon the raw surface, or by soaking the lint in a saturated solution of alum. Occasionally, the application of pounded ice will restrain the bleeding more effectually than anything else. Rubbing the wound freely with nitrate of silver or sulphate of copper is sometimes useful. The actual cautery, the Vienna paste, and the different acids, have all been recommended when

the hemorrhage resists the more ordinary measures; but the objection to them is that, when the eschar drops off, and frequently even before, the bleeding is apt to recur with increased violence. Finally, when the blood proceeds from the nasal cavity, uterus, or rectum, the most efficient adjuvant will be the tampon.

SECT. V.—DISEASES OF THE ARTERIES.

The arteries are liable to inflammation, acute and chronic, suppuration, softening, ulceration, and various kinds of transformations.

1. ACUTE INFLAMMATION.

Acute arteritis is generally induced by external injury, or by an extension of disease from the adjoining structures. Nevertheless, it occasionally exists as an idiopathic affection, or comes on without any assignable cause, chiefly in persons of a gouty or rheumatic predisposition, from the age of thirty to fifty. Restricted, in the majority of instances, to one or more of the larger trunks, it not unfrequently involves the smaller branches, and sometimes even the capillaries. Occasionally, the disease appears to pervade nearly the whole arterial system.

When arising spontaneously, the disease usually begins in the internal membrane and subserous cellular tissue, from which it gradually spreads to the other tunics; the reverse happening when it is induced by external violence. The anatomical characters of acute arteritis are redness, opacity, rugosity, and softening of the lining membrane, with an engorged, lacerable, and thickened state of the outer and middle coats. When the inflammation is severe, the parietes of the affected artery are generally remarkably pulpy, and so much diminished in consistence as to be easily torn or divided by the ligature. The nutrient vessels are loaded with blood, and often exhibit a real varicose aspect, their ultimate twigs ending apparently in the subserous cellular substance. With regard to the redness of the internal membrane, it is liable to considerable diversity; generally speaking, it occurs in small patches, which are diffused over a considerable extent of surface, and which vary in diameter between that of a split pea and a five-cent piece. In intensity, it ranges from a light pink to a deep scarlet, through numerous intermediate shades of lilac and purple. In some instances the redness is uniform. With this change of color are always associated important alterations of texture. The inner membrane, losing its smoothness and polish, assumes a rough, fleecy aspect, and, owing to the softened state of the subserous cellular tissue, is easily detached from its natural connections. Globules of lymph, either alone or blended with pus, occasionally adhere to its inner surface; and, in the larger arteries, it is not uncommon to meet with well developed pseudo-membranes, similar, in all respects, to those of the serous textures. The other tunics are also much affected, being moist, tumid, friable, and transformed into a reddish, homogeneous mass, almost devoid of cohesive power. Their elasticity, naturally so great, is partially lost, and in many instances they are freely infiltrated with serosity, sanguinolent fluid, or even pure pus. A common occurrence

is the formation of fibrinous concretions, closing up the caliber of the affected vessels.

Suppuration of the arteries is probably more frequent than is commonly imagined. The matter being generally deposited upon the inner surface of the vessels, is swept away by the circulating current as fast as it is formed, which is the reason, doubtless, why it is not oftener noticed after death. Sometimes, however, it is entangled in the substance of the false membranes, infiltrated into the arterial tunics, or collected into small abscesses between the inner and middle tunics. Arteritis is much less liable to terminate in suppuration than phlebitis, in which respect the one resembles inflammation of the serous membranes, the other of the mucous.

The arteries are almost insusceptible of *gangrene*. Their conservative powers are certainly very great, and hence they often escape destruction in the midst of parts that are perfectly deprived of vitality. In such cases, their outer surface becomes incrusted, at an early period of the disease, with a thin layer of fibrin; and, long before the sloughs begin to separate, the blood coagulates in their interior, thus opposing an effectual barrier to the occurrence of hemorrhage.

Softening of the arteries is a common occurrence, especially in the smaller branches. It is often witnessed in organic diseases of the principal viscera, and is a frequent attendant upon acute inflammation, cancerous affections, and the application of the ligature. The lesion is characterized, as the name indicates, by a diminution of the cohesive power of the vessels, the coats of which are rendered friable, spongy, and inelastic. It is generally accompanied with slight tumefaction, engorgement of the capillary vessels, and effusion of serosity, or sanguinolent fluid into the interstitial cellular tissue.

The *symptoms* of acute arteritis are generally so obscure as to render it extremely difficult to distinguish it, especially when it occurs in the more deep-seated vessels. In the majority of cases, the attack strongly resembles one of rheumatism. The most reliable phenomena, in a diagnostic point of view, are excessive pain and tenderness along the course of the affected arteries, increased by pressure, cough, and change of posture, and accompanied by violent and tumultuous throbbing, which is sometimes felt over the greater portion of the body, and may often be easily perceived at a considerable distance. The action of the heart is much increased in force and frequency, the pulse is hard, wiry and thrilling, and the system is disturbed by irritative fever, which rapidly assumes an asthenic type. When the disease is at all extensive, the patient soon succumbs under its influence, the immediate cause of death being either exhaustion from the violence of the inflammation, or from the formation of fibrinous concretions in the larger arteries, thereby arresting the circulation in some of the more important organs.

There are no symptoms denotive of suppuration, ulceration, or softening of the arteries, apart from those of acute or chronic inflammation. The formation of matter would probably be ushered in by rigors, followed by copious sweats, hectic irritation, and excessive prostration, but the occurrence would hardly be of so marked a nature as to serve any diagnostic purpose.

The *treatment* of acute arteritis must be conducted upon general antiphlogistic principles; by the lancet, purgatives, and antimonials, if the patient be young and plethoric, or by a conservative course, if he be weak, decrepit, or exhausted by previous suffering, intemperance, or dissipation. Aconite, veratrum, or colchicum, will usually form valuable additions to the other means, especially if they be combined with morphia, which is so necessary to allay pain and quiet the heart's action. If the disease is connected with a rheumatic diathesis, calomel must be given, in full and frequently repeated doses, with a view to early but gentle ptyalism. Colchicum will also prove useful in such a case. The most suitable topical remedies, when the affected arteries are superficial, are leeches, iodine, and saturnine lotions, in union with laudanum.

2. CHRONIC AFFECTIONS.

The most common chronic affections of the arteries are the fibrous, earthy, and atheromatous transformations, which, although of frequent occurrence, are chiefly interesting in relation to the influence which they exert upon the production of spontaneous aneurism. It is for this reason, therefore, that they should be carefully studied. These transformations, notwithstanding that they differ from each other widely in their physical and chemical properties, possess several characters in common, of which the most important are, first, that they are met with almost exclusively in elderly subjects; secondly, that they render the coats of the vessels brittle, and, consequently, prone to rupture; thirdly, that they nearly always occur in association with each other; and, lastly, that they usually begin in the cellular tissue, between the inner and middle tunics, which, however, in time, commonly participate in the degeneration.

The *fibrous transformation* is characterized by the appearance of small, hard, firm patches beneath the serous layer of the arteries, usually isolated, but sometimes grouped together, of no definite shape, thin, and of a whitish, grayish, or pale yellowish aspect. When the patches are numerous or unusually large, they convert the affected arteries into firm, inelastic tubes. The matter which gives rise to this transformation is originally deposited in the form of fibrin, which gradually assumes the properties here assigned to it.

The *earthy degeneration* is most common in old subjects after the sixtieth year; it usually, however, begins to form as early as the forty-fifth, and cases of it have been observed in very young children. Although it may take place in any of the arteries, it is most generally met with in the aorta and its larger branches, as the iliac, femoral, popliteal and innominate. What is remarkable, and, in the present state of the science, altogether inexplicable, is, that, while the artery of the thigh is so frequently ossified, the humeral artery is seldom affected. Another fact, not less singular, is that this transformation is comparatively rare in the female; a fact which satisfactorily accounts for the difference in the relative frequency of spontaneous aneurism in the two sexes. We occasionally meet with an instance in which

there is a strong ossific diathesis, or tendency to this degeneration, nearly all the arteries in the body being converted into rigid cylinders. The earthy matter is deposited in an amorphous form, and is destitute of bone corpuscles; consisting essentially of phosphate and carbonate of lime, in combination with a small quantity of albumen, which apparently serves as its matrix.

The calcareous matter exists in various forms: sometimes in small grains and nodules; now in scales, plates, and patches; and now in complete rings, which, encircling the vessel, convert it into a firm, rigid, inflexible tube (fig. 179), completely destitute of its natural attributes. The inevitable effect of these changes, which are always most conspicuous in the inner coat, is to render the artery abnormally brittle, and, therefore, ill able to withstand the pressure of its contents.

Fig. 179.

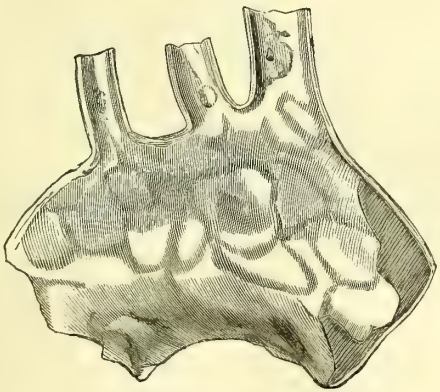


Deposition of calcareous matter.

The starting point of this deposit is the subserous cellular tissue, whence it gradually extends to the substance of the inner and middle tunics, both of which are sometimes completely transformed by it. It is rare that the outer coat suffers from it; such a change, however, is not impossible, and I have seen specimens in which the deposit was apparently entirely restricted to it. The exciting cause of the calcareous transformation is chronic inflammation. That this is the case is rendered clearly manifest by the fact that it is invariably accompanied by more or less thickening and induration of the arterial tunics, independently of those produced by the deposit itself.

The *atheromatous* deposit (fig. 180), now usually denominated the *fatty degeneration*, is, I believe, very rare among our native inhabitants, although it appears to be sufficiently common in our emigrants, especially the Irish and English. In Europe, it is said to be more prevalent in Great Britain than in any other country; a fact which accounts for

Fig. 180.



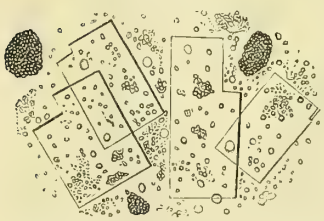
Atheromatous deposits.

the remarkable frequency with which aneurism occurs in that part of the world. However this may be, the deposit always begins in the subserous cellular substance, generally in minute, isolated points, not larger than the head of a pin, of a pale yellowish, whitish, or brownish color, somewhat greasy to the touch, and of a semi-concrete, friable consistence. In time, many of these points, or dots, coalesce, and so form irregular-shaped patches, which, pushing the lining membrane before them, may involve the whole circumference of the tube, and extend several lines or even inches up and down in the direction of its length. Having remained stationary for an indefinite period, the deposit manifests a disposition to softening and disintegration, and is ultimately converted into a curdy, friable, or, more properly speaking, a pap-like substance, possessing, apparently, all the properties of scrofulous pus. At this stage of the disease, the lining membrane is often elevated into small pustules, or little abscesses, which, bursting, discharge their contents into the blood, thus leaving a corresponding number of ragged and irregular ulcers, the base of which is formed by the middle tunic.

The fatty deposit is most common in the aorta, particularly its thoracic portion, near the origin of the great cervical trunks. Its occurrence is almost peculiar to the aged. What the causes are, under whose influence it is developed, has not been ascertained. That it is occasionally connected with imperfect alimentation, and the inordinate use of ardent spirits is unquestionable; but that these circumstances are essential to its production, as some pathologists contend, is what we cannot admit; because the disease, as is well known, has been frequently witnessed in the stoutest and most temperate subjects, a fact which is entirely at variance with such a conclusion.

Under the microscope the atheromatous matter is observed to consist of albuminous and earthy particles, of crystalline plates of cholesterine, of an imperfect fibrous texture, and of oil globules. The amount of fatty substance is frequently so great that it imparts a greasy stain to paper when dried on it by heat. The minute appearances of this deposit are well shown in the accompanying sketch (fig. 181).

Fig. 181.



Fatty granules, with crystals of cholesterine, from atheromatous deposits in the aorta.

In regard to the different transformations now described, there are no remedies, which, so far as is at present known, are capable of exerting any influence over their development. What treatment might accomplish, if their diagnosis could be satisfactorily established, is an interesting problem for future inquiry to solve. To speak of administering remedies for their removal when we are unable to determine the fact of their existence is one of those practical refinements which are more befitting the transcendentalist and the idle speculator than the man of sound sense.

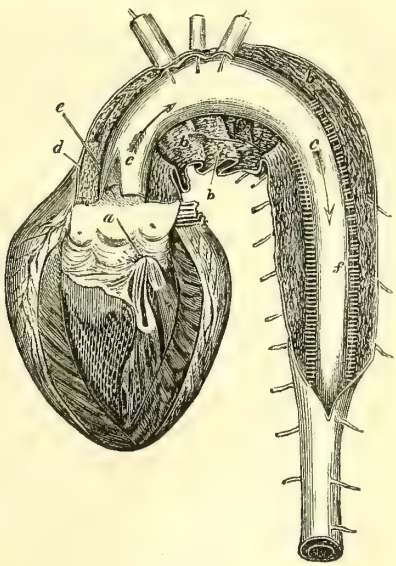
Ulceration, as a consequence of arteritis, whether acute or chronic,

is seldom witnessed. Manifesting a peculiar predilection for the larger trunks, it commonly commences in the serous membrane, from which it gradually extends to the middle and outer tunics until it leads to complete perforation. Such a termination, however, is extremely rare. The ulcers, which are very irregular in respect to their form, vary much in their size, number, and general characters. At times they are very small, scarcely exceeding the diameter of a mustard-seed; but they may be as large as a split pea, a five cent piece, or even a guinea, according to the size of the affected tube. Their margins are usually ragged, irregular, and considerably elevated, but seldom injected; their bottom, which is rough and uneven, is commonly formed by the middle tunic, the fibres of which frequently present a shreddy, lacerated appearance. In many instances, the erosions look like so many fissures, cracks, or chaps, with sharp, prominent, and irregular borders. This form of the disease is ordinarily dependent upon the presence of calcareous matter. The number of ulcers is seldom considerable, though in a few rare cases the inner surface of the larger trunks has been found completely checkered with them. When confined to the internal tunic they sometimes admit of cicatrization.

3. INTRA-PARIETAL SEPARATION.

There is an affection of the arteries, occurring exclusively in old persons, more particularly in women, to which the term *dissecting aneurism* has been applied; it is not, however, in reality, an aneurism at all, but merely a separation of the lamellæ of the middle tunic, as has been satisfactorily established by the investigations of Dr. Pennock, and by an examination by myself of nearly all the reported cases of the disease. A more appropriate name would be *intra-parietal* separation. The lesion, which presents nothing of any practical interest, inasmuch as it is always fatal, is entirely limited to the aorta and the larger trunks more immediately connected with it, and is always dependent upon organic disease of the coats of the arteries, rendering them lacerable, and, consequently, incapable of resisting the impulse of the blood. The manner in which the affection takes place is easily understood.

Fig. 182.



Dissecting aneurism from Pennock. *a*. Semilunar valves; *b*. External vessel laid open in its entire extent, so as to expose the aorta at *c*; *d*. Valvular opening in the coats of the aorta, showing the communication of this vessel with the artificial channel, *b*; the probe *e* passed through the abnormal opening: *f* exhibits the foramina between the aorta and the outer canal.

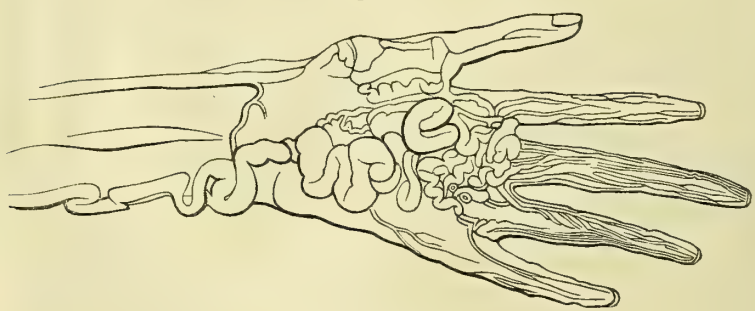
In the natural state the different coats are so intimately connected together that it is almost impossible, even by the nicest dissection, to detach them from each other; but when they are altered by disease, or by some of the degenerations to which they are so liable, the connecting cellular tissue is rendered soft and friable, and their separation may then be effected with the greatest facility. In this condition, moreover, the tunics themselves are frequently very much changed, so that they are scarcely able to resist the slightest impulse. Now, if under these circumstances the lining membrane gives way, whether from ulceration, erosion, or rupture, the blood will insinuate itself into the accidental opening, which is thus gradually enlarged, at the same time that the fluid is forced on between the layers of the weakened middle tunic, dissecting them from each other as with a knife, and forming thus either a blind pouch or a distinct canal, open at both extremities, or at some intermediate point.

The separation is not of the same extent in all cases. It rarely embraces more than one-fourth, one-half, or two-thirds of the circumference of the tube, while in length it may vary from six, eight, or ten lines to as many inches. Occasionally it reaches nearly from one extremity of the aorta to the other, being perhaps prolonged at the same time into the carotid, subclavian, and iliac arteries.

4. VARICOSE ENLARGEMENT.

The arteries are liable to a dilated and nodulated condition, similar to that of the veins, and hence very frequently termed varicose enlargement. The affection has also been described under the name of varicose aneurism and of arterial varix. Its general features are well illustrated by the adjoining cut (fig. 183). The lesion, which is

Fig. 183.



Varicose enlargement.

exceedingly rare, is met with chiefly in the superficial arteries, particularly in those about the head, the forearm, hand, leg, and foot; and consists in a remarkably tortuous, elongated, and convoluted state of these vessels, evidently dependent upon the effects of inflammatory action, as is shown by the fact that their coats are always abnormally thickened, either uniformly, or alternately thickened and attenuated.

In elderly subjects it is generally associated with the fibro-cartilaginous, earthy, or fatty degeneration. The dilatation and varicosity sometimes affect an entire artery, but more commonly they are limited to particular portions of it; it may be restricted to one vessel, or occur simultaneously in several. When the diseased artery is superficial, the character of the lesion is rendered sufficiently clear by the tortuous and nodulated course of the vessel beneath the surface; but there are no pathognomonic signs when it is deep-seated.

This affection rarely requires any treatment; for, even when the enlargement is considerable, it is rather an inconvenience than an actual disease. In ordinary cases, the vessels may be supported by the constant use of a well-applied bandage, or of an apparatus constructed upon the principles of the laced stocking. During the forming stage, much may be done in the way of repressing development by astringent and soothing lotions, along with rest and elevation of the parts, and the occasional abstraction of blood, provided the patient be plethoric, in order to moderate the momentum of the circulation. When the disease proves troublesome, by causing pain and functional disorder, the only effectual remedy is ligation of the offending vessels, at the cardiac side of the enlargement.

SECT. VI.—ANEURISM.

An aneurism is a pulsating tumor, occupied by blood, and communicating with an artery deprived, either in part or completely, of its integrity.

The subject of aneurism has been encumbered by too many divisions and subdivisions, and the consequence is that several lesions have been included under it which do not, properly speaking, appertain to it. The effect of this over-refinement has been to embarrass the study of this disease, and to invest it with difficulties which are altogether foreign to it. The distinction of aneurism into true and false is one of great importance, and should, therefore, be retained. The same may be said in regard to spontaneous and traumatic aneurism. The term dissecting aneurism, introduced by Laennec, and adopted by most modern authors, should be discarded, inasmuch as the affection which it serves to designate has nothing whatever in common with aneurism; it is, in fact, as already stated, merely a separation of the coats of the arteries, without any tumor or symptoms denotive of that lesion. Then, again, as to the term varicose, which I have myself employed, along with others, in my writings, to designate a peculiar form of arterial lesion, it is obviously improper when we come to make a practical application of it. A varicose artery is, in reality, no more an aneurism than a varicose vein; both affections consist essentially in a dilated and tortuous state of these two classes of vessels, and not, like aneurism, in a pulsating tumor, caused by the destruction, partial or complete, of the tunics of an artery. An anastomotic aneurism is a pulsating tumor formed by hypertrophy of the arterial and venous capillaries of a part; critically speaking, therefore,

the term aneurism is not applicable to it, and yet, as it has been fully engrafted upon our surgical nomenclature, it is difficult to dispense with it, or to substitute one of a more expressive and appropriate character.

The term true is applied to that species of aneurism in which one or more of the arterial tunics, without being necessarily perfect, form a part of the tumor. A false aneurism, on the contrary, is one in which all the coats have given way, the sac being composed of the surrounding cellular tissue in a state of condensation. It was formerly supposed, chiefly through the influence of the writings of Scarpa, that there was no such disease as a true aneurism, but that in every instance, whatever may be the size, form, or site of the affection, there was a complete absence of the arterial tunics at the situation of the tumor. This opinion, however, has become obsolete, experience having shown that there are cases, although they are confessedly rare, in which the aneurism clearly consists of at least one, if not more, of the coats of the artery from which it springs. Each of these great divisions comprises several varieties, founded principally upon the form and volume of the tumor. Thus an aneurism is said to be sacculated when it consists of a distinct bag, as so often happens in aneurism of the aorta and the principal branches given off from it; the term cylindroid is used when the swelling affects the artery uniformly in its entire circumference, while the tapering tumor is known by the appellation of fusiform. The words circumscribed and diffused refer merely to the dimensions of the aneurism.

The annexed sketches afford a good idea of the arrangement of the tunics of the arteries in the principal varieties of spontaneous aneurism.

Fig. 184.



Fig. 185.



Fig. 186.

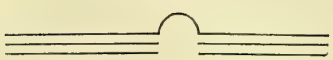
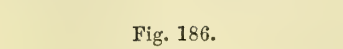


Fig. 187.



In fig. 184 the tumor is formed by the expansion of all the coats of the vessel, an extremely rare event; in fig. 185 the middle tunic has given way, the inner and outer being preserved; in fig. 186 the aneurism is formed by the external tunic alone; in fig. 187 the two outer membranes have been ruptured, the inner projecting through the crevice thus left in the form of a hernia. This variety is very uncommon, but cases of it have been reported by different authors, especially by Haller, Laennec, Dupuytren, and Dubois. It can only occur when the inner coat of the artery has been thickened and fortified by interstitial and surfacial deposits.

Finally, aneurisms are divided into internal and external, the former expression being used chiefly in reference to the aorta and to the arteries of the viscera, the latter in relation to the vessels of the extremities, the head, and neck. The words spontaneous and traumatic sufficiently explain themselves.

1. LOCALITY, PREVALENCE, AGE, SEX, AND CAUSES.

Spontaneous aneurism does not occur with equal frequency in all parts of the body; on the contrary, there are a number of arteries which are almost entirely exempt from it, or which, at all events, so seldom suffer as to be scarcely entitled to notice. The vessel which is most frequently involved is the aorta; first in its ascending portion, then in the thoracic, and, lastly, in the abdominal. Next in point of liability to the disease is the popliteal artery, the femoral, common carotid, subclavian, innominate, axillary, and external iliac. The arteries of the leg and foot, the hand, forearm, and arm, the face, upper part of the neck, and of the viscera, together with the common and internal iliac, rarely suffer in this wise. Traumatic aneurism may occur in any of the arteries, but is most common in such as are most exposed to external injury.

If we attempt to inquire into the causes which induce spontaneous aneurism more frequently in one artery than in another, we shall be met by difficulties. Several circumstances, however, may be assigned as affording at least a plausible explanation of the circumstance.

1st. It is well known that certain arteries are peculiarly prone to the calcareous and atheromatous degenerations, while others, on the contrary, are almost entirely exempt from them, whatever may be the condition of the rest of the arterial system, or the age of the patient. Now, dissection has shown that those vessels which are most frequently diseased in this way are also those which are most frequently affected with aneurism, and conversely. Spontaneous aneurism of the arm and forearm is among the rarest occurrences, and everybody knows how free their vessels are from the degenerations in question. In the aorta and popliteal artery, on the other hand, they are extremely common, and it is here, as already seen, that spontaneous aneurism is most frequent.

2d. In the next place, some influence is no doubt due, in the production of this difference, to the force with which the blood impinges against the walls of the vessels. Thus, in the aorta, which is more prone to aneurism than any other vessel, the ascending portion, particularly its anterior and right side, suffers more frequently than any other part, and it is here that the blood exerts its greatest force, as it is pumped up from the left ventricle. The popliteal artery, which comes next in the order of involvement, is subjected, in a degree beyond that of any other vessel in the extremities, to a similar influence during the flexed condition of the limb.

3d. It is not improbable that some influence is also due to the weakness which the arteries experience at the origin of their larger branches. The fibres of the middle tunic suffer a species of separation here, in consequence of which they are less capable of withstanding the shock of the blood as it is directed against them. However this may be, experience teaches that aneurism is peculiarly liable to occur at these points.

4th. Another circumstance which may be supposed to favor the

production of aneurism is the motion to which the arteries are subjected, especially during sudden and violent efforts. Such an influence must be particularly felt by the ascending portion of the aorta during bodily and mental excitement, and by the popliteal artery in the various muscular exertions of the lower extremity.

How far any one of these causes alone is capable of producing aneurism, is altogether a matter of conjecture. Without degeneration of the arterial tunics, they would probably exert but little influence, while under opposite circumstances it must be very great. Indeed, it is very questionable whether aneurism would be one-twentieth part as common as it is, if the arteries were altogether exempt from the earthy and atheromatous deposits; nay, we may go further, and assert, positively, that if these deposits could be prevented, spontaneous aneurism would almost cease to exist.

The occurrence of aneurism would seem to be influenced by climate or *locality*. The infrequency of the lesion in the inhabitants of the southwestern States of North America, is proverbial. In a practice in Ohio and Kentucky of twenty-three years, in which I witnessed almost every surgical disease incident to the human race, it rarely occurred to me to meet with an example of spontaneous aneurism. My experience, in this respect, is fully sustained by that of Dr. Dudley, of Lexington, whose practice embraced a wide field, which has since been so successfully cultivated by Professor Bush, of Transylvania University. Both these gentlemen assured me, some years ago, that this affection had been extremely rare within the range of their observation. Professor T. G. Richardson, now of New Orleans, superintended, while Demonstrator of Anatomy in the University of Louisville, the dissection of several hundred bodies, and yet he hardly met with an instance of the malady. The testimony of Dr. Bayless, who formerly occupied the same position, is precisely to the same effect. To what this extraordinary immunity is due, we have no means of determining. The population of that region of the United States is a mixed and laborious one, made up from all parts of the civilized world, and pursuing all kinds of occupations, from the most delicate and refined to the most rude and vigorous, and yet a case of spontaneous aneurism, in any class of its citizens, is absolutely an anomaly. My impression is that the disease is equally uncommon in our northern and middle States; but upon this subject it is necessary to speak with some degree of reserve, as we have no positive data to guide us.

In regard to the prevalence of aneurism in our larger towns and cities, our information is also very imperfect. Professor Gibson, formerly of the University of Pennsylvania, asserts that the disease is quite infrequent in Philadelphia, and this I am inclined to believe to be the fact, from the results of my own inquiries. In New York, on the contrary, it would seem, according to the statement of Dr. Mott, to be quite frequent; a circumstance which is, perhaps, not surprising, when we consider the heterogeneous character of the people of that city, and, above all, the extent of its commerce, and the numerous accidents incident to its pursuits. What is remarkable is, that nearly all the cases met with by this distinguished surgeon, during a period of upwards of

forty years, occurred among native-born citizens of the United States. In opposition to this fact, however, I have the authority of Dr. John Watson and others, of New York—as communicated to me by Dr. Lente—for stating that the great majority of cases of aneurism in that city, especially in hospital practice, are met with among those of foreign birth. The negroes of that city would also seem to be particularly obnoxious to the disease.

Aneurism is uncommon in the East and West Indies, in the British Provinces of North America, and on the continent of Europe, especially France, Italy, and Germany. In Great Britain, on the contrary, it is sufficiently frequent; more so, perhaps, than in any other part of the globe. According to the report of the registrar-general, it appears that the number of deaths from aneurism, in England and Wales alone, during a period of five years—namely, from 1838 to 1842—was 593; being an annual average of one in about 131,000 of the inhabitants. The various hospitals of London receive every year a large number of cases of this disease. The people of Ireland are said to suffer more frequently from aneurism than any other race.

The *causes* of aneurism are divisible into predisposing and exciting. Of the former, the most constant, and, therefore, the most important, is a diseased condition of the arterial tissues, usually presenting itself in the form of the earthy and atheromatous degenerations. These degenerations, by rendering the coats of these vessels preternaturally brittle and lacerable, cause them to yield more readily under the impulse of the blood and the various extraneous circumstances which have a tendency to stretch and twist them. I have already expressed the belief that, but for these alterations, spontaneous aneurism would be almost unknown. The influence of age and climate in the production of this disease, is adverted to in the preceding paragraphs. All laborious pursuits, involving sudden and violent muscular exertion, powerfully predispose to its occurrence. Hence, it is more common among sailors, and those who are much accustomed to athletic exercises, than among any other class of individuals. Soldiers suffer much less frequently than was formerly supposed. Men engaged in agricultural pursuits, although their labor is often severe, are, in great measure, free from the disease, owing, doubtless, to the want of liability of their arteries to abnormal deposits. Protracted courses of mercury, a syphilitic taint of the system, and the constant and inordinate use of ardent spirits, are supposed to predispose to the formation of aneurism; but how far, or in what degree, remains to be demonstrated.

The immediate cause of aneurism is rupture of the coats of the arteries, in consequence of severe muscular exertion unduly stretching these vessels; or, as in the case of the aorta and its larger offsets, an inordinate impulse of the blood, during the sudden and violent contraction of the left ventricle of the heart. The vessels, weakened by the degeneration of their tissues, and deprived of their elasticity, readily yield to the forces thus applied, commonly at a particular point, which is afterwards converted into a distinct pulsating tumor, composed generally, in great measure, if not exclusively, of the external tunic of the artery along with more or less of the circumjacent cellular

tissue. Sometimes the exciting cause of the disease is ulceration, but such an occurrence is comparatively rare, especially as an affection unconnected with the earthy and atheromatous deposits. This process, as stated in a previous section, should not be confounded with the cracks or fissures which so often follow these deposits, seeing that the latter are usually the result, not of a vital action, as is the case in true ulceration, but of a mere mechanical one, gradually effected under the impulse of the blood, as it rushes over the inner coat of the diseased vessel.

Aneurism occasionally exists simultaneously in several arteries. Thus it is by no means uncommon for a patient to have one tumor of this kind in the aorta and another in the carotid, subclavian, popliteal, femoral, or external iliac artery. I have seen several instances of the co-existence of popliteal aneurism in the same individual. When the disease affects a considerable number of arteries, it constitutes what is termed the *aneurismal diathesis;* a circumstance which imperatively contraindicates surgical interference, however favorably the external tumor may be situated for operation. Weak, sickly persons, of depraved constitution, and intemperate habits, are the most common subjects of this diathesis. Several remarkable examples of this predisposition to the formation of aneurism are upon record. Pelletan gives one in which the number of tumors was upwards of sixty, and in another, related by J. Cloquet, there were more than two hundred, the patient being a man fifty years of age. The aneurisms, in this instance, affected nearly all the arteries in the body, but they were most numerous in those of the extremities, the axillary, humeral, radial, ulnar, femoral, popliteal, tibial, and peroneal being all closely studded with them.

It has long been known that the formation of aneurism is influenced, in a remarkable degree, by *age.* Prior to the age of thirty, the disease is extremely rare, and up to the period of puberty it is almost unknown, even in the aorta, which is so much more frequently affected than the other vessels. The greatest number of cases, by far, occur between the thirty-fifth and fiftieth year; a good many cases are also met with during the next decennial period and a half, but after that time the malady is very rare; probably not that the predisposition to it ceases, but because, as it seems to me, in the first place, the number of subjects is comparatively small; and, secondly, because persons at this age are much less exposed to violent muscular and mental excitement than during the meridian of life. That this supposition is true, is rendered highly probable by the fact that the earthy and atheromatous deposits generally exist in greatest abundance in advanced life. The absence of these deposits in young subjects readily explains the non-occurrence of aneurism in children and adolescents. An instance of spontaneous popliteal aneurism in a boy only nine years old occurred in the practice of Mr. Syme, of Edinburgh, in 1844, and is the only case at this early age upon record.

Males suffer from aneurism more frequently than females, but in what precise proportion has not been determined. The question has hitherto engaged but little attention, and it is obvious that it can be

decided only by the analysis of a much larger number of cases than have yet been adduced for the purpose. It has been alleged that the relative frequency of carotid aneurism in the two sexes is nearly equal, and the occurrence has been attempted to be accounted for on the supposition that the arteries of the neck of the female are nearly as much exposed to all kinds of violence and muscular exertion as those of the male. Little confidence, however, can be placed in such opinions; for, before we can receive them as true, we must be satisfied that the disease is as common in women as in men, which I am very certain it is not. Mr. Crisp, in his excellent work on the diseases of the arteries, states that of 551 cases of aneurism of all kinds, more than seven-eighths occurred in men.

Having long been impressed with the belief, founded upon numerous dissections, that the difference in the relative frequency of aneurism in the two sexes was due, not to any difference in their occupation, but to the difference in the relative frequency of the earthy and fatty degenerations of the arteries, I was induced to institute special inquiry into the subject, and am gratified to be able to say that my views are fully confirmed by the statements of Dr. D. Hayes Agnew, Dr. C. E. Isaacs, Professor T. G. Richardson, and Professor J. B. S. Jackson. The testimony of these teachers, who are all well known as able and experienced practical anatomists, tends to show, indisputably, that females are much less subject to chronic disease of the arteries of every description than males. Neither their information, however, nor my own, is such as to enable me to determine the relative proportion of these degenerations in the two sexes, in a given number of cases. That it corresponds very closely with the difference in the number of cases of aneurism is what I am ready to believe, and what, I doubt not, future observation will abundantly verify.

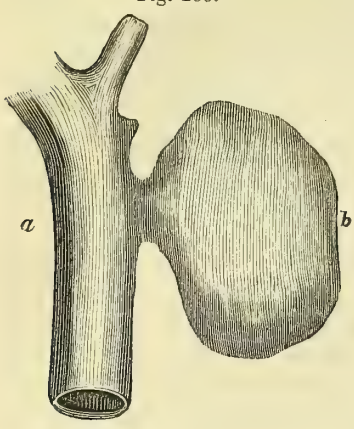
If we assume what I have here said to be true, it follows that the opinion which ascribes the greater frequency of spontaneous aneurism in males than in females to their more laborious occupation, their more intemperate habits, and their greater exposure to all kinds of disease, is entirely untenable, and, therefore, unworthy of confidence. Women, it is true, are not sailors, carpenters, blacksmiths, or hod-carriers, but in many parts of the world they are tillers of the soil, and engaged in almost every variety of pursuit calculated to rupture the arterial tunics if they were in a serious state of disease, such as we so often meet with in the other sex.

2. VARIETIES OF ANEURISM.

True aneurism presents itself under two varieties of form, differing from each other materially in their appearance and mode of formation, although their essential symptoms and effects are usually perfectly similar, if not identical. These two varieties are the tubular and the sacciform, terms which are sufficiently expressive of their general conformation. Each consists of one or more of the arterial tunics, and forms a tumor, which, in time, is capable of exerting the most injurious effects upon the neighboring structures, and of causing the death of the patient.

The *sacciform variety* (fig. 188) is by far the more common of the two. It essentially consists, as the name denotes, in the formation of a pouch, bag, or sac, connected with the side of the affected artery. In the tubular variety the tumor is formed at the expense of the entire circumference of the vessel; in this, on the contrary, it occupies only a limited portion of it. The arteries which are most liable to suffer from sacciform aneurism are the aorta, particularly its thoracic division, the popliteal, femoral, innominate, carotid, and subclavian. The number of tumors is subject to considerable diversity; cases have been reported in which there were so many as to constitute a genuine aneurismal diathesis, nearly all the principal arteries in the body affording several examples of its occurrence. In general, however, there is only one, although others may form during its progress. Thus it occasionally happens during the march of popliteal aneurism that an aneurism forms in the aorta, the carotid, or in the popliteal artery of the opposite side. The co-existence of aneurism in different parts of the body, and the tendency to its successive development deserve special attention on account of their practical relations; a subject to which allusion will again be made in another part of this chapter.

Fig. 188.



Sacculated aneurism. *a*. Artery; *b*. Aneurismal pouch.

The sacciform aneurism is capable of assuming a great variety of forms; the most common, however, is the globular, or ovoidal; in rare cases it is conical, elongated, or irregularly flattened, like a shot-pouch. Much diversity also obtains in regard to its dimensions; thus, while in some instances it is hardly the volume of a hazelnut, in others it is as large as the fist, or the head of the patient; in general, however, it does not exceed a hen's egg, or a medium-sized orange. The largest aneurisms of this kind are usually found in the aorta and in the popliteal, iliac, and innominate arteries. The attachment of the tumor to the artery is commonly effected by a narrow footstalk; but cases occur in which it takes place by a broad and extended base, and, under such circumstances, it is not unusual for the artery to suffer serious compression during the progress of the disease.

The orifice of communication (fig. 189) between the sac and the artery varies in different preparations. When the tumor arises by a narrow footstalk the opening is usually proportionably small, with smooth and well-defined margins. When, on the other hand, it is attached by a broad base, the aperture is always much larger, and its edges are also more irregular, sometimes, indeed, quite shreddy and ragged, as if they had been torn. The situation of the orifice is commonly towards the centre of the sac, but it may be at one side, or even at one of its extremities. The form of the opening is extremely varia-

ble, and admits of no specific description. In the early stage of the disease, and in nearly all cases where the tumor is small, the orifice is of a rounded or circular configuration, while in cases of an opposite character it is generally more or less irregular. The internal and middle tunics may terminate abruptly at the margins of the opening of communication, or they may extend into the cavity of the sac, and thus serve to give it a partial lining.

Fig. 189.



Aneurism of the aorta. The greater part of the cyst filled with clot. Aperture of communication small.

The composition of the sac is easily understood. For the most part it consists simply of the external tunic, the inner and middle having given way either prior to, or during, the development of the disease. The first thing, in fact, that usually happens, in all such cases, is the destruction, by ulceration or some other disorder, first, of the internal, and, soon after, of the middle layer of the artery, leaving thus a kind of crevice, which gradually enlarges under the influence of the impelling column of blood, and thus permits the corresponding portion of the vessel, now of course greatly weakened, to be converted into a pouch. This pouch, usually called the aneurismal sac, is originally, then, composed exclusively of the external coat of the affected vessel, the other strata terminating abruptly at the margin of the opening of communication, neither of them being prolonged into its interior. But this pouch would be very weak, and, consequently, ill adapted to withstand the shock of the blood as it rushes into its interior if it were not strengthened by adventitious aid, derived from interstitial deposits in the surrounding cellular tissue. We accordingly find that nature, ever on the alert to save the part and system, is prompt in supplying the required relief by setting up inflammation and pouring out plastic matter, both in the substance of the sac and in the neighboring structures, thereby thoroughly gluing them together, at the same time that they are greatly increased in thickness and density, and thus enabled more effectually to resist the effects of the ever-beating, dashing, and tumultuous sanguineous current within. Such aid, then, is wise and needful, and, fortunately, always comes in play at an early stage of the disease, the laceration of the inner and middle tunics of the artery, and the pressure of the blood against the tumor being sufficient causes of inflammation.

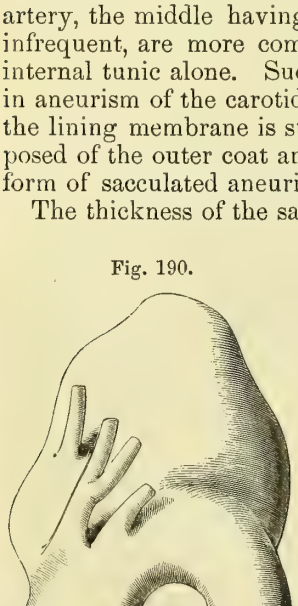
Although the sac is generally composed of the outer tunic alone, cases, nevertheless, occasionally occur where it consists, in the first instance, exclusively of the inner coat, the other two having given way. That such an arrangement is exceedingly infrequent, is proved by the fact that many surgeons of large experience have warmly contested the possibility of its existence. Haller and his cotemporaries, however, met with undoubted cases of it, and, in more recent times, it has been witnessed by Breschet, Dupuytren, and other observers, who have given particular descriptions of it. One ground for assuming that

this form of aneurism cannot occur is, that it has never followed the numerous attempts that have been made to produce it in the inferior animals, by exposing the carotid artery and dissecting off its outer and middle tunics. In every experiment of this kind, the denuded membrane maintained its integrity, and the breach was speedily repaired by a free deposit of plastic matter. There is, however, no analogy between a sound and a diseased artery, and this fact should be borne in mind in the discussion of the subject. When the outer and middle tunics are destroyed by ulceration, as they always must be in such a case, not rapidly, but by slow degrees, it is not difficult to suppose that the inner membrane may, at the injured and weakened part of the vessel, be made to bulge across the opening, in the form of a thin, translucent cyst. Interstitial deposits would soon aid in strengthening the cyst, although ere long, and before it has acquired any considerable bulk, it would be obliged to yield to the resistless impulse of the blood within. Haller designated this form of aneurism by the term hernia of the inner coat of the arteries.

Cases in which the sac consists of the outer and inner coats of the artery, the middle having been destroyed, although also exceedingly infrequent, are more common than those in which it consists of the internal tunic alone. Such an arrangement is occasionally observed in aneurism of the carotid, femoral, and popliteal arteries; but, in time, the lining membrane is sure to give way, leaving thus the cyst composed of the outer coat and the surrounding tissues, as in the ordinary form of sacculated aneurism.

The thickness of the sac varies, in different cases and under different circumstances, from the fourth of a line to the fourth of an inch. Its consistence is often remarkably tough, and, in cases of long standing, it is generally composed of several distinct strata, of a grayish, whitish, or drab-colored aspect, consisting of fibres which intersect each other in every conceivable direction. The outer surface of the tumor is rough and shreddy; the internal, on the contrary, is smooth and polished, only, however, as a general rule, in its earlier stages, for in time it also becomes rough, and is finally incrusted with fibrinous matter. Notwithstanding the thickness of the aneurismal sac, and the efforts which nature makes to strengthen it, it gradually dilates (fig. 190) under the impulse of the inflowing column of blood, and at length, after the lapse perhaps of several months, manifests a disposition to yield at one or more points, very much as an abscess does, the activity of the absorbent vessels exceeding that of the capillary.

Fig. 190.



Sacciform aneurism of the aorta ready to give way.

The sacciform aneurism always contains, even at an early period after its formation, *fibrinous concretions*, the presence of which con-

stitutes one of its most interesting and important features, as they are evidently designed, not only to strengthen the tumor, but to aid in its obliteration, and, consequently, in the production of a permanent cure, although such an event is extremely rare. In their arrangement, these clots are always concentric, not unlike the layers of an onion, one being piled upon, and closely connected to, another. Their color and density vary according to the period of their formation, the older being usually of a pale, yellowish appearance, and of a firm, fibrous consistence, while such as are of a comparatively recent date, exhibit very much the aspect and consistence of a common heart clot. Their thickness ranges from the fourth of a line to that of a sheet of paper; and their number is often immense, thousands existing in a tumor perhaps not larger than an ordinary fist. That these concretions are organized, at least in many cases, is evinced by their intimate adhesion, not only to each other, but also to the inner surface of the sac, by their extraordinary density, and by their yellowish hue, which contrasts most strikingly with that of recently deposited fibrin and coagulated blood. These circumstances show that these lamellæ undergo most important changes after they have been deposited; that absorbent vessels are busily engaged in carrying away the serum and coloring matter of the blood, and in solidifying the fibrin after it has been extricated from the general mass; while the successive development of concretions clearly denotes that the process is as much a vital as a mechanical one. No one, I believe, has yet succeeded in demonstrating any vessels in these strata; but that they are always present, and that often in great numbers, in cases of long standing, does not admit of any reasonable doubt. We may look upon these clots, then, as exceedingly interesting structures, capable, after a certain period, of maintaining a kind of independent existence, and whose primary object, in all cases, is to strengthen the aneurismal sac, and, under favorable circumstances, to fill it up, so as to effect a radical cure. What adds to the force of this conclusion is the fact that, when a cure of this description has been effected, the tumor is gradually brought under the influence of the absorbent vessels, by which it ultimately entirely disappears, with the exception, perhaps, of a little nodule, not larger than a pea, and just sufficient to indicate the former site of the disease. It is proper to observe that the recently-formed strata of an aneurismal sac are, in general, very imperfectly, if at all, organized; they are certainly not vascularized and furnished with absorbents.

How are these aneurismal concretions formed? Upon this subject there still exists some contrariety of sentiment. Most pathologists, however, suppose, and very correctly, as I think, that they are deposited from the blood as it sweeps over the inner surface of the sac, during which more or less of its fibrin is disengaged, while the other elements of the fluid are sent forward to mingle with the current in the affected artery. This opinion derives plausibility from the fact that the development of these strata always proceeds most rapidly when there is a comparatively small orifice of communication, with a languid state of the systemic and aneurismal circulation. It has been conjectured that the clots had their origin in an effusion of plastic matter,

such as occurs in traumatic injuries and ordinary inflammation; but for such a view I can myself perceive no just ground, as it is impossible to discover the slightest similarity between the two processes. I have stated in the preceding paragraph that the act of formation is both a mechanical and a vital one; mechanical as far as the mere separation of the fibrin from the blood is concerned, and vital as it respects the decolorization, condensation, and intimate adhesion of the concretions.

The *tubular aneurism* is extremely rare; it is observed principally in the aorta, and the branches which are immediately detached from it, especially the innominate, carotid, and iliac, and consists in a uniform dilatation of the vessel, usually composed of all its tunics in varying degrees of alteration. In its shape, the tumor is commonly somewhat spindle-like, and hence it is often described under the name of fusiform aneurism; the term cylindroid has also been applied to it, as its conformation occasionally partakes strongly of that character. The word tubular, however, is more expressive of its appearance, and I therefore adopt it in preference to any other. The annexed drawing (fig. 191), from a specimen in my collection, affords a good idea of this variety of the disease.

Fig. 191.



Tubular aneurism of the aorta. *a*. The aorta, much hypertrophied. *b*. The heart.

The size of the tubular aneurism varies from slight increase of the normal diameter of the vessel to a tumor capable of receiving a large fist. When it occupies the arch of the aorta, it often projects up into the neck so as to form a prominent swelling above the sternum, admitting of satisfactory examination, both by touch and auscultation. The distance between the origins of the carotid arteries is greatly increased, and the aneurism generally encroaches sensibly upon the heart. In nearly every instance its length considerably exceeds its diameter. The dilatation of which it consists seldom terminates abruptly, but is usually lost by insensible degrees in the vessel above and below, thus giving the tumor the appearance of two cones united at their bases. In the smaller arteries, as, for example, the innominate, the aneurism sometimes involves the whole length of the vessel.

The structure of the tubular aneurism is usually made up of all the tunics of the affected artery, in a notable state of alteration, of which hypertrophy constitutes the most striking feature. In two remarkable specimens in my collection, the different tunics are immensely thick-

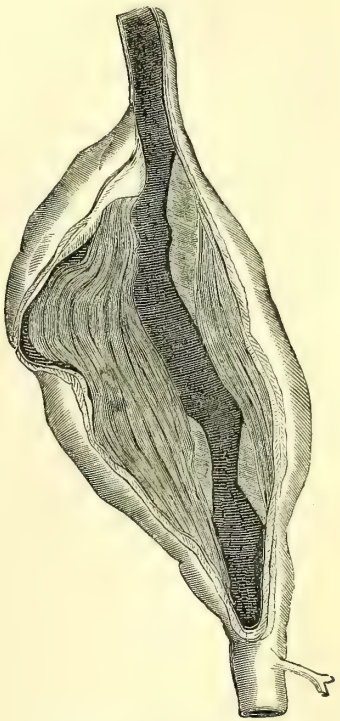
ened, and increased in strength and density, the effect, evidently, of long-continued interstitial deposits; they both occupied the arch of the aorta, extending as far as the origin of that vessel, and were taken from male subjects upwards of fifty years of age. The lining membrane has lost its white and glossy appearance, and has been replaced by a thick, opaque, and rugose structure, having none of the properties of the original texture. The middle coat is at least ten times as thick as naturally, very strong, elastic, and deprived of its yellowish hue; the outer one is also greatly changed in its appearance, being remarkably strong, thick, and firm. No evidence whatever exists in any of the tunics of the earthy, atheromatous, or fatty degeneration.

From a careful examination of this form of aneurism, it appears to me to consist essentially in a dilatation of the caliber of the artery with hypertrophy of its different tunics. The first step, probably, in its formation is chronic inflammation, causing weakness of the walls of the vessel, and uniform enlargement of its diameter. By and by, however, as the dilatation increases, the coats become strengthened in every direction by interstitial deposits, and it is thus that a tumor is at length formed capable of offering great resistance to the impulse of the blood. It is owing to this superaddition of matter that the tubular aneurism so seldom gives way by rupture, a circumstance in which, as well as in several others, it differs remarkably from the sacciform variety of the disease.

It is not to be supposed, from what precedes, that this form of aneurism always consists of the different tunics of the affected artery; this is unquestionably true in most cases, but we now and then meet with an instance in which the lining membrane, and perhaps, also, the middle layer, are partially deficient, thus causing irregularity in the dilatation, unless, as occasionally happens, the defect is atoned for by plastic deposits. Indeed, the retention of all the tunics would seem to be an essential condition to the formation of the true tubular aneurism; if the inner and middle lamellæ be destroyed, even to a small extent, the blood will dilate the vessel unequally, and inevitably give rise to a sacculated tumor. It is in this way that we may explain the occasional coexistence of the two forms of the malady.

The tubular aneurism is remarkable, besides some of the characters already pointed out, for the absence of fibrinous

Fig. 192.



Aneurism, by dilatation. The abnormal space is almost entirely filled up by fibrin; the arterial canal remaining clear. Spontaneous cure exists in an advanced stage.

concretions, which are so common in the sacciform; and the circumstance may be employed as an additional evidence of the correctness of the view, so long and so generally entertained, that the formation of these substances takes place directly from the circulating fluid, and not as an effect of the deposition of plastic matter, consequent upon inflammation, as some have conjectured. If the development took place in the latter way, it ought to be of frequent, if not of constant occurrence, inasmuch as the inner coat of the affected artery is seldom entirely free from inflammation, and would thus afford a large surface for the effusion of fibrin; but every one who has ever examined a specimen of tubular aneurism, knows how extremely rare it is to find its walls incrusted with anything. In the annexed sketch (fig. 192), copied from the work of Mr. Hodgson, a tubular aneurism is seen occupied by concentric concretions, with a central canal, which preserved the continuity of the vessel, and thus permitted a continuance of the circulation. The stratification appears to have been very perfect.

3. SYMPTOMS OF ANEURISM.

The symptoms of aneurism exhibit, as might be supposed, much diversity, the principal circumstances which influence them being the nature, seat, and age of the tumor. Hence, in order to comprehend the subject thoroughly, it must be studied with special reference to these points.

In spontaneous aneurism, which usually depends upon rupture of the coats of the artery, the patient is often apprised of the commencement of the disease by the occurrence of a sharp pain, not unlike that produced by an electrical shock; he feels as if he had received a smart blow, and perhaps turns round to see who inflicted it. Occasionally, also, he is conscious of something having suddenly given way —he may even have heard a slight noise—and on examining the part a small pulsating tumor is found. Upon being interrogated as to the cause of the accident, he will usually state that it took place while he was engaged in some severe bodily exertion, as leaping, running, lifting, or coughing. But the origin of the disease is not generally thus marked; in the majority of cases, in fact, the patient has no distinct perception of its occurrence, and he is only apprised of its existence by degrees; not, perhaps, until it has already made serious progress. Such an event will be particularly apt to happen when the lesion consists essentially in a dilated condition of the arterial tunics, unattended with rupture, as it is then often extremely stealthy in its mode of invasion. In traumatic aneurism, on the contrary, the characteristic symptoms ordinarily show themselves immediately after the receipt of the injury of the vessel upon which the disease is situated.

The aneurismal tumor is usually quite small at its commencement, not exceeding, perhaps, the volume of a filbert, a small hickory-nut, or an almond; by degrees, however, it increases in size, and ultimately may acquire a bulk equal to that of a man's fist, or even of an adult's head. In its form it may be globular, elongated, ovoidal, conical, fusi-

form, or cylindrical; or so irregular as to defy description. However this may be, it is a living, beating tumor, rising and expanding synchronously with the contraction of the left ventricle of the heart. Its pulsations are often perceptible at the distance of a number of feet, especially in strong, plethoric subjects, and are always increased in force and frequency by whatever has a tendency to excite the general circulation. It imparts a distinct impulse to the hand, rising and falling as the blood enters and passes out; it is soft and elastic, and, in its earlier stages, permits itself to be emptied by steady and uniform pressure. Upon applying the ear to the tumor, a peculiar noise is perceived, differing very much in its character and intensity. In general, it is a sort of a sawing, rasping, or bellows sound, and so loud as to be heard with great distinctness at a distance of several inches; occasionally it is of a peculiar whizzing, whirring, or purring nature, and cases occur, although they are rare, in which it strongly resembles the buzzing of a fly in a bottle. The immediate cause of the sound is the manner in which the blood rushes into the tumor; its pitch is always greatest, other things being equal, when there is a comparatively small opening of communication, and when the sac, containing but little solid matter, is seated superficially.

The phenomena now described are, in general, susceptible of great modification by pressure applied to the artery above and below the tumor. In the former case, the size of the swelling is notably diminished, and all motion and noise disappear; in the latter, it is sensibly augmented, the tumor heaves and rises under the resistance, and the blood, rushing violently against the inner surface of the sac, at each systole of the heart, produces great tumult, with a corresponding increase in the intensity of the different sounds. Considerable changes in the aneurismal sounds are sometimes occasioned by the rugose condition of the margins of the orifice of communication, and by partially detached clots, or projecting filaments, within the sac, intercepting the column of blood, and causing various murmurs and vibrations, together with a tremulous shaking of the tumor, isochronous with its pulsations.

The pain attendant upon aneurism is constant, but subject to variation in its intensity; slight early in the disease, and while the swelling is still small; more severe and harassing as it progresses and encroaches upon the surrounding parts. Diversified in its character, it is generally dull, aching, and throbbing, as if matter were about to form; in some cases it is sharp and darting, in others dull, heavy, or gnawing. Occasionally it is of a neuralgic nature, coming in fits and starts, or, as sometimes happens, in regular paroxysms, once or twice in the twenty-four hours. The immediate causes of the pain are, inflammation of the sac and the pressure of this upon the neighboring structures; hence it is always greatest, as a general rule, in large and old aneurisms, and in those parts of the body which are most abundantly supplied with nerves.

For the same reason that the pressure of the tumor causes pain, the distal parts usually suffer from numbness, and a sense of aching and weariness. Their temperature is diminished; and they are weak and

crippled. Great swelling, of an œdematous character, is often present, the result, evidently, of the compression of the veins and lymphatics impeding the return of their contents. As the tumor enlarges, the distal portion of the artery contracts, and conveys less of its wonted supply to the lower parts. Gradually, however, this is compensated for by the collateral vessels, which, naturally existing, augment in size, and, in time, amply atone for the diminished stream in the main trunk. If it were not for this arrangement, the parts would soon shrivel and wither, or, worse, fall a prey to gangrene. Fortunately, such an event can only happen when the aneurism is of extraordinary bulk, or of very rapid development, thereby compressing also the collateral vessels and the principal nerves.

Aneurism of the thoracic aorta, and of the innominate and carotid arteries, is nearly always attended with distressing dyspnœa, severe pain, and palpitation of the heart, which is itself often seriously implicated in the disease, being especially liable to suffer from hypertrophy, softening, and fatty degeneration, along with chronic endocarditis and disorder of the tricuspid and semilunar valves. As the tumor enlarges, the respiratory difficulty rapidly increases, rendering walking painful, and the maintenance of the recumbent posture ultimately impossible. Compression of the trachea may induce asphyxia, and of the œsophagus, inanition. In the abdomen and pelvis, aneurism of the larger arteries, besides causing violent pain, may occasion serious functional disturbance, by interfering with the return of the blood in the vena cava, and thus leading to ascites and anasarca.

4. DIAGNOSIS OF ANEURISM.

Although the symptoms of aneurism are, in general, so well marked as to render it difficult to mistake their import, yet, as the disease may be simulated by other affections, and as doubts may thus arise in the mind of the inquirer concerning its true nature, it is necessary, in every case, however well-characterized it may apparently be, before he comes to a final decision, to institute a faithful examination into its history, progress, and present condition. It has been for the want of proper care in the investigation of this disease that some of the most serious and disgraceful blunders that disfigure the records of surgery have been committed; and, although such errors are now less frequent than they were formerly, owing to the more general use of the exploring needle, and a better acquaintance with pathological anatomy, yet it cannot be denied that what has occurred once may happen again, and that with tenfold effect, as it respects the character of the surgeon, who, to his skill as an operator, is always supposed to unite that of an enlightened diagnostician. The affections with which aneurism is most liable to be confounded are, chronic abscesses, glandular tumors, and encephaloid growths. Attention to the following circumstances will, if carefully remembered, enable the practitioner to avoid error.

1. Aneurism is always, from the first, seated in the direction of one of the larger arteries, whose course may often be distinctly traced by

the finger; it is soft and elastic, pulsates more or less violently, is free from pain, and is unattended with discoloration of the integuments. Abscess, on the contrary, begins as a hard swelling, and becomes soft only after it has passed through its different stages; if chronic, matter will form very slowly, and, although it may surround the artery, and thus receive its impulse, yet the peculiar fluctuation of the swelling, and the changes that may be induced in it by pressure and posture, will always suffice to prevent error. In acute abscess, there is severe pain, pus is poured out rapidly, and there is marked discoloration of the surface, with more or less constitutional disturbance. Glandular lymphatic swellings are most common in the neck, axilla, and groin in children and young persons of a strumous diathesis; they generally advance pretty rapidly, and after having attained a certain bulk, either remain stationary, or alternately advance and recede; they are usually multiple, and not unfrequently occur simultaneously on both sides of the body; external aneurism, on the contrary, is most common in the popliteal, femoral, innominate, and carotid arteries, in middle-aged and elderly subjects, and progressing slowly but steadily, never recedes, and rarely exists in more situations than one at the same time. Encephaloid growths occur at all periods of life and in nearly all regions of the body; soon acquire a large bulk; are of varying degrees of consistence, some parts being solid, some soft, and some semi-solid; are attended with great enlargement of the subcutaneous veins; and soon give rise to that pale and sallow state of the features known as the cancerous cachexia. Aneurism, as just stated, advances tardily, is of uniform consistence, especially in its earlier stages, is not accompanied by any enlargement of the subcutaneous veins, and, although the general health may seriously suffer, there is an entire absence of cancerous impress.

2. Aneurism pulsates the moment it is developed; no matter how small it may be, it throbs and heaves isochronously with the action of the heart, and possesses all the characteristic traits that distinguish it in its later stages, although they are perhaps less strongly marked. Abscesses and solid tumors, on the contrary, are seldom affected by the beating of the underlying vessel until they have acquired some bulk, and even then the impulse is often very faint, occurring rather as an undulatory movement than as a distinct shock.

3. In aneurism the tumor is generally firmly fixed, any attempt to grasp and lift it up proving abortive; possibly, it may be pushed gently to one side or the other, but this is all. Moreover, whatever changes may be effected in its relations none can be effected in its pulsations; it throbs and heaves as before. With solid growths this is not so; unless very large, they can be readily isolated from the vessel, and be thus deprived of all impulse, however strong.

4. The pulsation in aneurism is generally uniform, being perceived equally at every point of the circumference of the tumor, which rises and falls synchronously with the systole and diastole of the heart; in abscess and solid growths, on the other hand, it is very irregular, and is usually limited to a particular spot. In aneurism the swelling bounds and recedes under the hand; it feels as if it were alive and

panting; in solid tumors the morbid mass rises at each impulse, but there are no expansion and contraction.

5. When an aneurism is firmly and uniformly compressed, it sensibly diminishes in bulk, which, however, recovers itself the moment the hand is removed; in solid growths and abscesses pressure, however great, produces no such result.

6. In aneurism, the size of the swelling is diminished by pressure upon the cardiac side of the tumor, and increased by pressure upon the distal side. In morbid structures not aneurismal, no change of bulk follows this procedure.

7. The sounds of aneurism are different from those of solid tumors. Both may yield a sawing, bellows, or rasping noise, but in the latter this is never conjoined with the peculiar thrill, or whirring noise, which constitutes so prominent a symptom in the former.

8. Aneurism of the larger arteries ordinarily affords two alternate shocks, one of which corresponds with the diastole of the heart, the other with its systole. These phenomena are never present in solid tumors and abscesses, and are therefore pathognomonic.

Such are the distinguishing characters of aneurism and of the more important diseases with which it is liable to be confounded. It must be obvious, from what has been said respecting them, that mistake can only be avoided by the most rigid and thorough examination, made not once, but repeatedly, in every case of tumor situated along the course of an artery and influenced by its pulsation. Where, after such a pains-taking process, no satisfactory decision can be arrived at, our only resource is to insert a delicate exploring-needle, which, while it can do no possible harm, if it be properly employed, will at once determine the diagnosis.

5. EFFECTS AND TERMINATION.

The effects which aneurism exerts upon the surrounding parts vary according to circumstances, of which the most important are, the situation of the affected vessel, and the size of the tumor. An aneurism of the arch of the aorta will, other things being equal, produce more serious disturbance, both organic and functional, than one of the abdominal portion of that vessel, and an aneurism of the carotid artery than one of the popliteal. It is obvious also that a small tumor will, as a general rule, cause less serious effects than a large one.

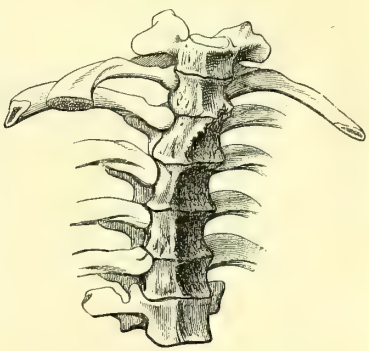
The effects which such a disease produces upon the parts with which it is in contact are purely of a mechanical character, eventuating in their displacement, compression, or ulceration, or in all these occurrences combined. An aneurism of the thoracic portion of the aorta must, necessarily, encroach more or less upon the contents of the chest, pushing the heart and lungs out of their natural position, and thereby interfering essentially with the performance of their proper functions. In aneurism of the carotid artery there will be displacement of the trachea, œsophagus, and the great vessels of the neck, along with compression of these parts, and also of the pneumogastric and sympathetic nerves. In popliteal aneurism the part of the limb below the

site of the tumor generally suffers from obstructed circulation, as is evinced by the occurrence of anasarca and decrease of temperature, with a feeling of numbness, the result of interruption of the nervous current. When the embarrassment to the flow of blood is very great, or long continued, mortification of the distal portion of the limb is liable to ensue.

When the tumor is situated externally it may produce serious changes in the muscles, which, in many cases, are not only widely separated from each other, but remarkably pale, flattened, and attenuated, exhibiting more the appearance of thin ribbons than of thick, solid, fleshy bodies. The nerves, too, are often very much spread out, the vessels are thrust aside, and the aponeuroses are stretched out like tense sheets. When pressing upon an important joint, the tumor is sure to impede its motion, and may even cause permanent anchylosis, as occasionally happens in aneurism of the popliteal artery.

The effect produced by aneurism upon the osseous tissue is sometimes very remarkable, and is generally most conspicuously displayed in the dorsal portion of the spine. When the disease involves the thoracic aorta, the tumor, which often attains a large size, being crowded into a comparatively small space, is liable to encroach sadly upon the bony walls of the chest, pressing upon and eroding the bodies of the vertebræ behind, as seen in the annexed cut (fig. 193), the sternum in front, the ribs at the side, and the clavicle above. There is hardly an osteological cabinet, of any extent, that does not afford striking evidence of the truth of this remark. I have seen specimens where as many as four of the bodies of the dorsal vertebræ were completely absorbed as far as the spinal canal, which, forming the posterior boundary of the tumor, was thus fully exposed to its pulsations. The sternum suffers mostly at its lateral and upper aspect, but occasionally, as in an instance now under my care, it is perforated at the centre, the movements of the aneurism being distinctly visible at that part. The ribs and their cartilages do not generally participate to any considerable extent in the erosion, and the clavicles are rarely affected, unless the tumor is of great bulk, and projects unusually high up into the neck.

Fig. 193.



Erosion of the vertebræ from aneurism.

It is not surprising, after what has been said respecting the effects which aneurism is capable of exerting upon the osseous tissue, that the tumor should occasionally cause serious lesion in the soft structures, apart from their mere compression. In its earlier stages, before the swelling has attained any considerable bulk, the inroads are slight, and, consequently, well borne, the parts manifesting no disposition to resent its encroachments; by and by, however, as it progresses, its

pressure bears heavily upon the adjacent textures, which, taking on inflammatory action, become matted together by interstitial deposits, which, for a time, thus materially strengthen the aneurismal sac. But this state of things is not destined to last long; gradually the morbid action increases, the superincumbent tissues are more and more expanded, and, at length, ulceration setting in, the integuments yield over the more prominent portion of the sac, followed by destructive hemorrhage.

6. SPONTANEOUS CURE.

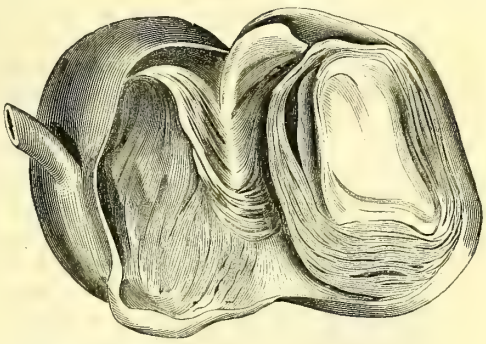
Unfavorable as the prognosis of aneurism generally is, it is extremely gratifying to know that a cure may occasionally be effected spontaneously, without the intervention of art in any way. That such an event is rare, forming merely an exception to the great law, is unfortunately too true; yet it sometimes occurs under circumstances apparently the most desperate, bidding defiance alike to medical and surgical skill. There are, indeed, few practitioners of enlarged experience, who have not met with cases of this disease in which, contrary to all calculations of the doctrine of chances, the patient made an excellent recovery, after having literally hovered, for days and weeks, over the very verge of the grave; where, in short, everything portended speedy destruction, and yet every vestige of the aneurism ultimately disappeared, the person living for years afterwards in the enjoyment of good health, and in the exercise of his former occupation. How the cure is effected in these cases, our information does not enable us to explain, as an opportunity is seldom afforded of making a dissection of the body after the event has taken place, in consequence of the individual being usually lost sight of. A knowledge, however, of the possibility of such a cure is highly encouraging, and holds out the hope that it may be of more frequent occurrence than has hitherto been imagined.

Although we are not always able to account for the manner in which the patient gets well in this disease, yet observation has demonstrated that it generally occurs in one of five ways, all leading, essentially, to the same result, namely, the formation of clots, by which not only the aneurismal sac is closed up, but also the artery immediately above and below it. When the cure is gradual, the clots are usually arranged concentrically, and exhibit every mark of organization; but the reverse is the case when it is effected suddenly, for then they are nothing but soft, red, blood-masses, similar to what we so often observe after death in the heart and large vessels.

1. The most common way in which the cure takes place is by the gradual filling up of the sac by the formation of clots, thereby ultimately converting it into a firm, solid tumor. The most beautiful and perfect specimen of this kind (fig. 194) that I have ever seen, was presented to me, some years ago, by an old pupil, Dr. Shumard, who had removed it from the body of a young steer. What renders it still more interesting, is the circumstance that it was connected with the hepatic artery, which had given way at one side from the rupture, apparently, of its inner and middle tunics. The tumor, which is of a

rounded shape, and nearly three inches in diameter, is occupied by hundreds of lamellæ, many of them not thicker than a sheet of paper, of a pale grayish color, closely adherent to each other, concentrically arranged, of a dense, firm texture, and, beyond question, thoroughly organized, even those most recently deposited. At the centre of the tumor, a small irregular cavity exists, which still admitted some blood, as is proved by the fact that the hepatic artery is completely pervious. This mode of reparation is greatly facilitated by the small size of the opening of communication between the artery and the aneurismal sac.

Fig. 194.



An aneurismal tumor obliterated by the deposition and organization of fibrin.

2. Another mode of spontaneous cure is the occurrence of inflammation, followed by the coagulation of the contents of the sac, and the ultimate obliteration of its cavity as well as of the artery in its immediate vicinity. The disease may begin in the tumor itself, or be propagated to it from the circumjacent structures; if it be mild and slow, the cure may be easy and safe; but if it be very active, it may terminate in suppuration, and thus endanger life by hemorrhage, the matter being evacuated along with the clots before the artery is hermetically sealed by an internal coagulum.

3. The reparation occasionally occurs through the intervention of gangrene, either beginning in the tumor itself, or extending to it from the parts immediately around it. The blood coagulates in the sac as it does in an artery in ordinary gangrene, and when the sloughs separate the clots are discharged, the gap being afterwards closed by the granulating process. Such a mode of restoration must necessarily be infrequent, inasmuch as the morbid action by which it is effected generally terminates fatally.

4. The contents of an aneurism are sometimes solidified by the compression of the artery leading to it, caused either by the tumor itself or by some morbid growth in its immediate vicinity. Such a result may follow with nearly equal certainty, whether the pressure be applied to the cardiac or to the distal portion of the vessel.

5. Finally, a very rare mode of spontaneous obliteration may take place, consisting in the detachment of a small clot and its introduction into the distal portion of the artery, thereby more or less completely blocking it up. The blood, being thus checked in its onward flow, soon coagulates, just as it does in artificial compression. It was upon a knowledge of this species of spontaneous cure that Mr. Fergusson recently attempted to found a new mode of treatment of aneurism by

breaking up the contents of the tumor by manipulation, and thus urging them on into the communicating vessel.

When, by any of the above modes, a radical cure is effected, the tumor is gradually brought under the influence of the absorbent vessels, and is ultimately completely obliterated, or, at all events, so far reduced as to leave only a small nodule, indicative of the former site of the disease. The period required for the perfection of these changes varies from three or four weeks to as many months, according to the size of the aneurism and the state of the part and system.

Although an aneurism may, as we have just seen, occasionally get well by the unassisted efforts of nature, yet such an event forms merely an exception to a great law, in conformity to which the disease almost uniformly proves fatal. The period at, and the mode in, which, this takes place vary in different cases and under different circumstances, and can, therefore, be pointed out only in a general manner. In aneurism of the aorta, especially in the arch of this vessel, the disease often produces death in less than three months from its commencement; in the innominata its course is also generally rather rapid, and a similar remark applies to aneurism of the primitive iliac; in aneurism, on the contrary, of the carotid, subclavian, axillary, external iliac, femoral, and popliteal arteries, the fatal event is often postponed several months longer. To these statements there are, of course, many exceptions; thus, on the one hand, we occasionally meet with an aneurism which ends fatally in a few weeks, the tumor expanding rapidly, and perhaps bursting quite suddenly during a violent muscular effort; and, on the other hand, the disease may continue, with very little variation, as to size, for a number of years.

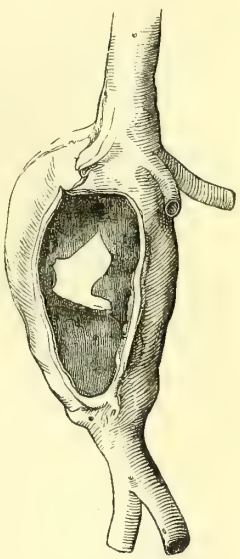
There are three distinct modes by which aneurism may cause death: 1. By the injurious compression which the tumor exerts upon the neighboring organs. 2. By the sudden rupture of the sac, and the occurrence of hemorrhage. 3. By the development of inflammation, suppuration, or mortification.

1. Aneurismal tumors of the neck and chest often cause death by compression of the trachea and bronchial tubes, although perhaps not as frequently as has been generally supposed, owing to the wonderful power which these tubes possess of flattening themselves, so as to make room for the entrance of the air into the lungs. Indeed, I am inclined to think, from my knowledge of this subject, that death from direct suffocation, from this cause, is an uncommon event. Great difficulty is often produced by the pressure of the sac upon the pneumogastric and phrenic nerves, and it is extremely probable that life is sometimes destroyed in this way, the more especially if the pressure be conjoined with serious lesion of the air-passages. Finally, death occasionally proceeds from compression of the heart and lungs, interfering with the circulation and respiration; or from compression of the œsophagus, causing inanition. In the abdominal and pelvic cavities, and also in the extremities, the danger from compression is much less, as the structures here are less important to life, as well as more disposed to yield under the encroachment of the tumor.

2. After an aneurismal tumor has attained a certain bulk it is ex-

tremely apt to give way, either suddenly or gradually, under the impulse of the blood, or under severe muscular exertion (fig. 195). Such an occurrence will be the more likely to happen when the tumor has been of rapid growth, and especially if its interior has not been fortified by the formation of hard, organized clots, so as to increase the thickness and strength of its tunics. It is in this manner that most of the internal aneurisms which do not cause destruction by mere compression, ultimately terminate, the immediate cause of death being hemorrhage into some internal and contiguous organ. Thus, in the chest, the tumor usually opens into the trachea, the bronchial tubes, the pleura, pericardium, mediastinum, or œsophagus. Sometimes a communication is established between the sac and the heart, between it and the pulmonary artery, or, lastly, between it and the cava. An aortic aneurism has also been known to burst into the spinal canal, some of the bodies of the vertebræ having previously been destroyed by absorption. In the abdomen, the tumor may break into the peritoneal cavity, or into one of the hollow viscera, as the stomach, intestine, or urinary bladder. In the neck, axilla, groin, and extremities, the aneurism, if permitted to pursue its course, generally finds its way to the surface, very much after the manner of an abscess.

Fig. 195.



Aneurism of the descending aorta; burst. The patient died suddenly in consequence. The aneurism produced mainly by dilatation.

The hemorrhage succeeding to the rupture of an aneurism may be slight, as when the aperture is small or devious, or copious and destructive, as when the opening is large or straight. Most commonly, life is worn out by the frequent recurrence of the bleeding; thus, twenty ounces of blood may be lost to-day, in a week twenty or thirty ounces more, and so on until the patient dies completely exhausted, his condition being, in the meantime, perhaps seriously aggravated by serous effusions into some important cavity. Occasionally the aneurism gives way by a large rent, and the patient expires instantly in consequence of the hemorrhage.

3. More or less inflammation attends all aneurisms; whatever may be their volume or situation, their age, or character, they play the parts of intruders, encroaching upon, compressing, and irritating the surrounding structures, and thus giving rise to various deposits, especially of serum and plasma. It is by means of the latter that, as was previously stated, the sac increases in thickness and density, so as to qualify it the better to bear with impunity the impulse of the inflowing current of blood; without such an occurrence few tumors of this kind would be able to maintain themselves for any length of time, but would soon yield to the resistless pressure from within; in a word, speedy rupture of the sac, and fatal hemorrhage would, in most cases,

be inevitable. But, although inflammation is set up for wise and beneficial purposes, the process, unfortunately, is not always kept within the strict limits required to fortify the sac and protect it against early rupture; on the contrary, many circumstances occur to provoke its increase, and to cause it to pass into ulceration, suppuration, and even mortification. Among these circumstances some are of a constitutional, and others of a purely local character; thus, mere plethora and the use of stimulating food and drink, may powerfully augment the inflammation, and bring about these untoward results. In general, however, it will be found that the mechanical compression of the tumor, in consequence of the resistance offered to its extension, has more to do with its production than anything else. Sometimes a clot is accidentally detached, and thus becomes a cause of mischief. In external aneurism, the manipulation employed in examining the tumor is occasionally productive of severe inflammation, and similar effects often follow the injudicious use of the affected limb.

Suppuration of the tumor is an infrequent event. A case occurred in 1857, at the Pennsylvania Hospital, in the service of Dr. Pepper, in which an abscess had formed in connection with an aneurism of the innominate, and killed the patient, a man aged 38, by bursting into the trachea. A report, with a drawing of the case, has been published by Dr. Humphreys, in the Transactions of the Pathological Society of Philadelphia. Ulceration and mortification are more common, and are particularly liable to take place when the tumor is of large size.

Finally, aneurism may prove fatal by exciting inflammation in an important internal organ, as the lung, heart, or pleura. In popliteal aneurism, the pressure of the tumor upon the nerves and arteries below sometimes causes death from mortification of the leg and foot.

Treatment.

Notwithstanding the vast amount of attention that has been bestowed upon aneurism, from the earliest periods of medical science down to the present, it may truly be affirmed that there is no subject connected with practical surgery which has been so little understood by the great mass of the profession as this. This circumstance has arisen, it seems to me, not so much from a want of ability on the part of the practitioner to comprehend the nature of this lesion, as from the obscure and imperfect manner in which it is usually discussed in our lecture-rooms and in our systematic treatises. Much difficulty also has grown out of the defective nomenclature of aneurism and of the ambiguity which, until recently, existed in regard to the pathology of this affection, both tending to give rise to erroneous ideas of practice. Light, however, is gradually breaking in upon us; and it is highly probable that the advances of modern science will enable us, ere long, to treat aneurism with as much confidence as any other class of maladies.

Leaving, for the present, out of view the treatment of internal aneurism, as belonging as much to the department of medicine as that of surgery, I shall proceed to consider the various remedies that have

been proposed for the cure of the external form of the disease, or, more properly speaking, of those cases of aneurism which are more directly and immediately amenable to the art and science of surgery. In doing this, it will be necessary to bear in mind the divisions of aneurism pointed out in the commencement of the section, as each of them will require corresponding modifications of management.

In the time of Celsus, as well as for a long period subsequently, the treatment of aneurism was conducted in the most cruel and unscientific manner. The only operation which appears to have been known was to lay open the tumor by a bold incision, and, after turning out its contents, to apply the hot iron to the extremities of the affected artery, so as to seal up their mouths. The effect of such a procedure may easily be imagined; upon the separation of the eschar, hemorrhage was sure to take place, and in this way nearly every patient perished, either at the first onset of the bleeding, or by its frequent repetition. This miserable practice continued in vogue until the introduction of the ligature by Ambrose Paré. A different mode of procedure was now adopted, although it can hardly be said to have been much of an improvement upon the one just described. It certainly, however, possessed the advantage of being more scientific, and of being less frequently followed by hemorrhage, notwithstanding it could claim little on the score of simplicity as far as its execution was concerned. It consisted in ligating the artery above and below the tumor, which was then freely opened, thoroughly cleared out, and stuffed with charpie, to promote suppuration and occlusion, the object being to heal the wound from the bottom. Occasionally the more adventurous surgeon took the more speedy route of extirpating the tumor, adopting a plan similar to that which is sometimes pursued at the present day in treating aneurism at the bend of the arm consequent upon venesection. The result of this operation, too, was often most disastrous; many of the patients died of the effects of inflammation, some of secondary hemorrhage, and not a few of the shock of the amputation performed as a dernier resort to save them from impending destruction. To prevent these sad occurrences, and afford the sufferer a better chance of recovery, the removal of the limb was often the only operation thought of for his relief.

a. DELIGATION OF THE ARTERY AT THE CARDIAC SIDE OF THE TUMOR.

It is amazing to think that some of the operations above described should have continued in vogue until near the close of the last century. The fact attests, more fully than any other circumstance with which we are acquainted, the low state of surgery up to that period. The merit of performing the first operation for the cure of aneurism upon strictly scientific principles is due to Mr. John Hunter, who flourished in the latter part of that century, and whose labors have shed so much lustre upon the healing art. From having witnessed so many failures from the ordinary procedure, he was led to the conclusion that the cause consisted in the fact that the artery was always diseased for some distance above the aneurism, and that it was, therefore, incapable of

becoming sufficiently occluded prior to the detachment of the ligature to prevent hemorrhage. Acting under this conviction, amply confirmed by dissection and observation, he determined, upon the first favorable opportunity, to apply the ligature upon a sound portion of the vessel. While thus revolving the matter in his mind, a man, laboring under popliteal aneurism, was admitted into St. George's Hospital, of which he was then one of the surgeons. The patient was a coachman, forty-five years of age, and the tumor, which had been first perceived three years previously, was not only quite large, but was attended with great swelling of the foot and leg. The operation was executed in December, 1785, the femoral artery being exposed a little below its middle, and surrounded by four ligatures drawn so gently as simply to bring the sides of the vessel together. "The reason for having four ligatures was," as is stated by Sir Everard Home, by whom the case was reported, "to compress such a length of artery as might make up for the want of tightness, it being wished to avoid great pressure on the vessel at any one part. The ends of the ligature were carried directly out of the wound, the sides of which were now brought together and supported by sticking-plaster and a linen roller, that they might unite by the first intention."

It is unnecessary to enter into any details respecting the after-treatment of the case. It will be sufficient for my purpose to state that on the second day after the operation the tumor had lost more than one-third of its original bulk; that the ligatures, some of which came away on the fifteenth day, excited severe inflammation in the artery, as well as in the surrounding parts; and that the man left the hospital on the 8th of July following, in good health, and with no appearance of any tumor in the ham. He subsequently resumed his former occupation as a coachman, and died from an attack of remittent fever, fifteen months after the operation. The limb being dissected, the femoral artery was found to be impervious as high up as the profunda, while below the site of the ligatures, as far down as the tumor, it was open, and contained blood, except just where it entered the aneurism, where it had become obliterated. The sac was a little larger than a hen's egg, but more oblong and flattened, and contained a solid coagulum adherent to its internal surface.

I have been induced to give a brief outline of this case for two reasons. In the first place, it deserves to be commemorated because it embodies the application of a new principle to the cure of a disease which, until then, was almost uniformly fatal; and, secondly, because it will enable us to establish, in a more satisfactory manner than we could otherwise do, the claims of Mr. Hunter to the credit of having originated the operation, which has been so sturdily denied him by the French surgeons, who have, almost with general consent, ascribed it to their countryman, Dominic Anel. I have no disposition to enter into the merits of this dispute, especially at this remote period, when everything relative to it should be fully understood; I shall, therefore, content myself with a recital of a few of the more prominent and important facts of Anel's operation, for these will be sufficient to show that it differs wholly and entirely from that of Mr. Hunter, and that,

so far from involving any new principle, it was merely a simplification of the old procedure.

The case of Anel, to whom surgery is indebted for some of its most valuable improvements, fell accidentally into his hands during a visit which he made to Rome in 1710. His patient was a Catholic priest, who, in consequence of having had the brachial artery pricked in venesection, was affected with an aneurism at the bend of the arm; the tumor was large, and being the seat of slight ulceration, seemed to have been on the point of bursting. Having controlled the circulation in the limb by means of the tourniquet, he cut cautiously down upon the artery, and after separating it from the accompanying nerve, he raised it upon a hook, and tied it as near to the tumor as possible. All pulsation in the tumor instantly ceased, the ligature came away on the eighteenth day, and at the end of a month the friar was able to use his arm quite as well as before the accident.

It will thus be perceived that the operations of the English and French surgeons differed from each other in every particular; and it is only surprising that there ever should have existed any contrariety of opinion respecting them. The procedure of Anel was executed for the cure of a traumatic aneurism; the artery was perfectly healthy, and it was tied in as close proximity to the tumor as possible, the Frenchman never supposing that he was about to establish a new principle in operative surgery; he nowhere alludes to such an intention, and his only object seems to have been to afford his patient, who was suffering great agony, and who might bleed to death at any moment from the sudden bursting of his tumor, prompt relief. The Englishman, on the contrary, had studied the subject with infinite care and attention; he had made numerous dissections and even performed some experiments upon the inferior animals, as the dog and horse, with a view of ascertaining the condition of the artery in aneurism and its ability to bear the ligature; and he had clearly perceived that, as the cause of failure of the old operation was that the ligation was always made too near to the tumor, the only safety would be to tie a sound portion of the vessel, even although this should be at a very considerable distance from the aneurism. His object was not to cut off the supply of blood at once, but simply to weaken its passage through the tumor, thereby giving its contents an opportunity of undergoing gradual coagulation, and at the same time preventing the distal parts of the limb from perishing from the sudden stoppage of the circulation. The result of the case above detailed proved the correctness of his reasoning, and established, upon a firm and immutable basis, what is now universally recognized in Great Britain and in this country, as the Hunterian operation for aneurism.

The operation of Hunter has been performed upon almost every artery of the body liable to suffer from aneurism. Even the aorta itself has been repeatedly tied, and, although the cases have all proved fatal, yet the result has been such as to show, most conclusively, that the event has been due much more to the injury inflicted upon the surrounding structures than to the violence done to the circulation by cutting off so great a quantity of blood from its accustomed channels.

Great simplicity now characterizes the operation; a healthy portion of artery is selected, great care is taken, in exposing the vessel, to disturb its sheath as little as possible, and only one ligature is used, but that is drawn so tightly as to lacerate the inner and middle tunics, when, a double knot being made, one extremity is cut off, and the other is brought out at the nearest point of the wound, which is then treated in the ordinary manner. Cessation of pulsation usually occurs at once upon tightening the ligature, although not necessarily so; sometimes, indeed, several days elapse before it is fully established, but even then, it is commonly very much diminished in force, thus paving the way for the formation of clots upon which the cure ultimately depends. The persistence of the circulation, after the main artery of a limb has been ligated, arises from the anastomosing branches continuing to pour their contents into that portion of the vessel which lies between the cord and the sac, as well as into the sac itself, and perhaps also into the distal portion of the artery. When these branches are inordinately large, or numerous, they may keep up such a supply of blood as to compromise effectually the success of the operation.

The operation is generally followed by a slight diminution of temperature in the limb, but this rarely lasts beyond a few hours, when it is succeeded by a marked increase of heat, owing to the augmented activity of the cutaneous circulation, in consequence of the blood being forced principally through the superficial capillaries. Subsequently, however, as the anastomotic branches enlarge, and the circulation becomes equalized, the temperature sinks again, and now perhaps somewhat below the normal standard, the parts really feeling, for the first time, the loss of blood occasioned by the ligation of the artery. In not a few cases the limb retains its temperature after the operation with hardly any variation, as if nothing at all had happened.

After-treatment.—The treatment after the operation must be conducted with great judgment and attention. The patient being carried to bed, the limb is placed in an easy and relaxed position, but not elevated, lest arterial influx be interfered with; and it is well, especially if there be a diminution of temperature, that it should be enveloped for some time in wadding. Cold applications must be carefully avoided, even if the skin manifest inordinate heat with some degree of swelling, as they could not fail to be prejudicial by lowering the vital powers, and so laying the foundation for mortification. A full anodyne should be administered immediately after the operation, to tranquillize the action of the heart; light diet is to be observed, with cooling drinks; and the temperature of the apartment is not permitted to exceed 65° of Fahrenheit. The bowels must not be opened for several days, and then only by the mildest laxatives, drastic purgatives being particularly objectionable on account of their tendency to cause excitement and throbbing of the arteries; occurrences which would inevitably be injurious after such an operation.

Causes of Failure.—The causes of failure after the Hunterian operation are, first, violent inflammation, followed by mortification; secondly, death of the limb from deficiency of blood; thirdly, secondary hemorrhage, either from premature detachment of the ligature, or rupture of

the sac; and, fourthly, maintenance of the circulation by means of a redundant anastomosis. None of these accidents, save the last, and that is a very improbable one, will be likely to happen if the part and system have been thoroughly prepared for the operation, if the disease has not made too much progress, and, finally, if proper care and judgment be employed in managing the case after the application of the ligature. Deligation of the carotid arteries for the cure of aneurism is liable to be followed by inflammation of the brain and lungs, with softening of the former of these organs and hepatization of the latter. Much of the mortality from the operation is caused by this disease.

No recent statistics of the Hunterian operation, on a large scale, have appeared. The most satisfactory, so far as I know, are those of Mr. Thomas Inman, of Liverpool, published in 1844. His table was made up of all the reliable cases that had been recorded up to that period in the various medical and surgical periodicals.

Name of the artery.	No. of cases.	Deaths.	Proportion.
Innominate artery	6	6	...
Subclavian artery	40	18	1 in 2
Carotid artery	40	11	1 in 4
Abdominal aorta	3	3	...
Common iliac	8	3	1 in $2\frac{2}{3}$
Internal iliac	4	2	1 in 2
External iliac	27	9	1 in 3
Femoral	42	7	1 in 6
Total	170	59	1 in 3

b. DELIGATION OF THE ARTERY AT THE DISTAL SIDE OF THE TUMOR.

It is well known that aneurism occasionally occurs so near the trunk as to render it impracticable to perform the Hunterian operation, or that the artery, although accessible at the cardiac side of the tumor, is too much diseased to enable it to support the ligature. Mons. Brasdor, a professor in the old school of surgery at Paris, upwards of seventy years ago, after much reflection upon the subject, arrived at the conclusion that gradual and efficient coagulation of the blood in the aneurism might be produced by placing the cord upon the artery at its distal aspect. He had no opportunity, however, of solving the problem upon the human subject. The merit of this was reserved for Deschamps, although the case upon which he tried it could hardly have been worse for such an undertaking. The patient, besides being old, was worn out by suffering, and the tumor, which occupied the upper part of the thigh, extending to within a short distance of Poupart's ligament, was nearly seventeen inches in circumference. The operation was tedious and difficult, on account of the depth of the artery and the absence of pulsation, but the vessel was at length discovered and effectually secured. Contrary, however, to expectation, the aneurism, which had made marked progress for some time previously, now rapidly increased in volume, and on the fourth day, when it appeared to be on the point of bursting, it was resolved to perform the ordinary operation, notwithstanding the reasons which had just before been urged against its

adoption. Two ligatures were applied, but the operation was attended with copious hemorrhage, and the man died in eight hours after.

The operation of Brasdor was next performed by Sir Astley Cooper, in a case of aneurism of the external iliac artery, extending so high up into the abdomen as to render it impossible to place a ligature between it and the heart. The femoral artery was, therefore, tied a short distance below Poupart's ligament, between the epigastric and profunda. The patient did well for some days, when the tumor, which had been gradually diminishing in volume, burst, causing death by hemorrhage.

What the result of these two attempts might have been, if the cases had been of a more favorable character, is a matter which must, of course, be left to conjecture. It is certain, however, that no attempt was made to repeat the operation until 1825, when, almost forgotten by the profession, it was performed by the late Mr. James Wardrop, of London, in a case of aneurism of the carotid artery. The success was complete. The ligation was followed by an immediate diminution of the tumor, which gradually progressed until, at the end of the fifth week, the neck had nearly regained its natural form; the ligature had dropped off, and the general health was entirely re-established. The patient, a woman aged seventy-five, continued to be perfectly well three years after the operation.

Having been equally successful in several other cases, Mr. Wardrop was induced to extend the principle of Brasdor's operation to aneurism of the innominate artery. It occurred to him that, by tying one of the branches of this artery, the force of the circulation might be so far diminished in the tumor below as to cause the solidification of its contents; and a favorable opportunity soon after arising, he was not slow in putting his ideas in practice. The patient, a female, aged forty-five, had a pulsating swelling, of the size of a turkey's egg, in the inferior part of the neck, its base being concealed by the sternum, and evidently connected with the innominate artery. For the cure of this disease the right subclavian was tied in July, 1827, with the effect of a gradual amelioration of the distressing symptoms, and the ultimate disappearance of the tumor, its site being occupied merely by an unnatural hardness, the result, probably, of the remains of the aneurism. This was the condition of the patient fourteen months afterwards, at which time the carotid artery still pulsated, although not so vigorously as the left, and the woman was in better health than she had been for a long time.

The procedure now described constitutes what is called Wardrop's operation, although it is in reality, as was before intimated, merely an extension of that of Brasdor; and is only applicable to aneurism of the innominate artery. It has been performed within the last fifteen years in a considerable number of cases, generally by tying the common carotid; but the results have, for the most part, been unfavorable, owing, as has been alleged, and as is probably the fact, to the occurrence of violent inflammation both in the aneurismal sac and in the vessels in immediate communication with it, terminating fatally in a few days, or, at most, in a few weeks.

Deligation of the artery at the distal side of the sac has hitherto been most disastrous. Thus, of 27 cases, collected by Mr. Erichsen, death speedily occurred in 20, while in the remaining seven, although the patients escaped with their lives, no benefit whatever resulted in regard to the cure of the aneurism.

The annexed cuts afford an illustration of the various methods of ligating arteries for the cure of aneurism, above described. A glance will serve to show how inefficient such an operation must be when performed according to the plan suggested by Mr. Wardrop.

Fig. 196.



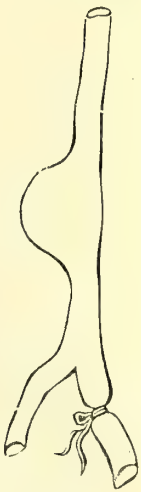
Hunter's.

Fig. 197.



Brasdor's.

Fig. 198.



Wardrop's.

c. INSTRUMENTAL COMPRESSION.

The treatment of aneurism by compression dates back to a very early period of the profession, and, although the principles upon which it was formerly conducted were far from being scientific, numerous cases have been published illustrative of its efficacy. It is not my design to inquire into the history of the operation, or to seek out its inventor for the purpose of awarding him praise for his ingenuity and enterprise; it is sufficient to state that the compression was originally applied directly to the tumor, or to the tumor and the limb upon which it was situated, either by means of an apparatus specially constructed for the object, or by a compress and roller, extended from the distal portion of the extremity upwards, beyond the seat of the disease. The practice was most frequently employed for the relief of traumatic aneurism, especially that form of it consequent upon injury of the brachial artery, at the bend of the arm, and, although it proved occasionally successful, not a few cases occurred in which it was followed by violent inflammation of the sac and limb, eventuating in ulceration, abscess, or gangrene.

In the latter part of the last century, Vernet, a French military surgeon, conceived the idea of curing aneurism by applying compression upon the artery immediately beyond the tumor, upon the same principle as that upon which Brasdor soon afterwards suggested the use of the ligature. He thought that the operation was particularly adapted to aneurism situated so near to the trunk as to forbid a resort to the ligature, or compression upon the cardiac side of the swelling. It would appear, however, that he practised it only in one instance—upon a man affected with inguinal aneurism—and that so great was

the disturbance which it created in the pulsations of the sac, that he was obliged, in a very short time, to abandon it. From the want of success attending the case, ill adapted as it was to test the principles of a new process, no one, it seems, felt afterwards disposed to make further trial of it, and it was accordingly forgotten, or remembered only as an ingenious suggestion.

Compression of the artery above the tumor, or between it and the heart, was first distinctly insisted upon as a remedy for the cure of this disease, by the late Mr. Freer, of England, in his observations on aneurism, published early in the present century. In the work here referred to, he gives particular directions for applying the compression, enjoining that it should be made by enveloping the whole limb with a bandage, and placing upon the vessel, in the most superficial portion of its extent, a small pad, which was then to be screwed down by means of a tourniquet. To render its action more effective, a plate was secured to the opposite side of the limb, which, while it defended the integuments and muscles from injurious constriction, concentrated the force upon the particular point of the artery where it seemed to be most needed. Notwithstanding this precaution, the application of the tourniquet was soon followed by pain and œdema of the extremity, generally so violent as speedily to necessitate its removal. Short, however, as the compression was, it occasionally laid the foundation of a cure, which was afterwards perfected by the steady but cautious use of the ordinary compress and bandage.

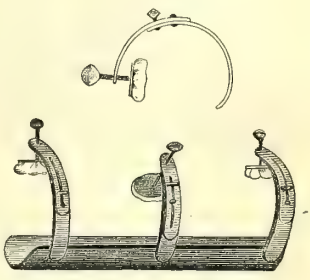
Acting upon the suggestions of Freer, Dupuytren and others applied themselves to this mode of curing aneurism, devising useful and ingenious instruments as substitutes for the more clumsy contrivance above described. The French surgeon, in particular, invented a most admirable compressor, at once simple and efficient, which still bears his name, and which he employed successfully in several cases of aneurism of the inferior extremity. The cures, however, that were effected in this way were few compared with the great number of failures, and the consequence was that the treatment never met with much favor. What added to the dissatisfaction of practitioners was that, in quite a considerable number of cases, it was followed by results highly prejudicial to the limb, if not to both limb and life.

Thus stood the treatment of aneurism by compression, when, in 1843, it was destined to experience a complete revolution in the hands of several eminent surgeons of Dublin, particularly Hutton and Bellingham, the latter of whom, in a short tract upon the subject, was the first to point out, upon correct and scientific principles, the manner in which it acts in curing the disease. Prior to this period, one replete with interest to the progress of surgery and humanity, compression was a very painful and haphazard proceeding, conducted without any discrimination and judgment, and, consequently, without any certainty as to its results. The idea was that, in order to succeed, it was necessary that it should be applied firmly and steadily, so as to arrest the circulation, and cause adhesion of the sides of the artery, very much as in the operation of ligation. Hence the poor patient was generally subjected to immense torture, often compelling the speedy discontinuance

of the treatment, which, however, notwithstanding this, was occasionally followed by the worst consequences, as manifested in the violent swelling of the affected limb, and perhaps its ultimate loss by gangrene. The procedure was altogether a blind one, and, therefore, just as likely to prove prejudicial as useful. It was employed by one practitioner simply because it had occasionally been employed successfully by another, and not because any one had, as yet, been so fortunate as to lay down any broad and definite rules of action. It was for this reason that it was so long in acquiring the confidence of surgeons; that it was totally abandoned at one time, and resumed, with doubts and misgivings, at another. Its principles were not yet fully developed, or placed upon a just and comprehensive basis. This labor was performed by Dr. Bellingham and his able associates, who thus created a new era in the treatment of aneurism, hardly less brilliant than that of the ligature. What the ultimate fate of this treatment will be time alone can determine; that it is destined to supersede entirely, as some have predicted, the use of the ligature, is extremely questionable, and yet, considering the remarkable success which has attended it, such an occurrence seems not improbable.

Compression, as now conducted, is not only safe, but comparatively free from pain; and, although it is often tedious, yet few cases will ultimately resist its influence. It is more particularly applicable to the cure of popliteal aneurism, in which its greatest triumphs have hitherto been achieved, but it has also been successfully employed in aneurism of the lower part of the femoral artery, and in aneurism of the brachial, particularly at the bend of the arm. It is applied at the site of the Hunterian operation, that is, upon a sound portion of the vessel, at the cardiac side of the tumor, and generally at a considerable distance from it; gently and intermittently, not firmly and persistently, as in the old method; just sufficiently to retard and weaken the circulation in the sac, not to arrest it, and so as to favor the gradual formation of clots; allowing time for the development of the collateral vessels, and the maintenance of the nourishment of the distal portion of the member. Occlusion of the artery at the site of compression is not wished for; on the contrary, it is desirable that the vessel should remain pervious, and retain as many of its normal properties as possible. As the stratification of the sac proceeds; as layer after layer of fibrin is deposited, and becomes firmly cemented to that which preceded it, the hollow pouch is gradually filled up, and usually, along with it, also the upper orifice of the artery. To this rule, however, there are occasional exceptions, the blood continuing to flow from the artery in a direct stream across the sac in a sort of ditch, groove, or narrow channel.

Fig. 199.

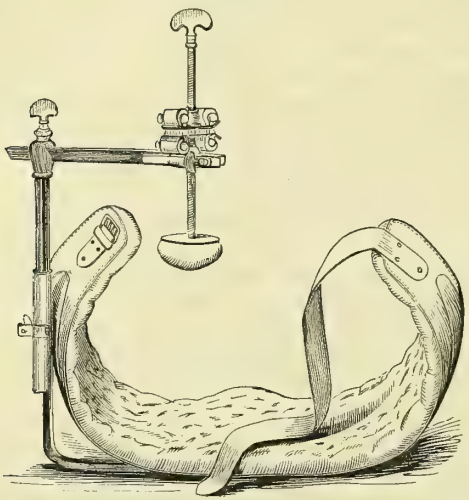


For the purpose of making the compression, various instruments have been devised, one of the most simple and efficient of which is represented in the ad-

joining sketch (fig. 199); it is a modification of that of Charrière, and was successfully employed by Dr. Gibbons, of this city, in a case of aneurism of the popliteal artery. It consists of a long, wide, concave, steel plate, supporting three semicircles of the same metal, arranged in two segments, which slide upon each other, and are connected each at their free extremity with a screw and pad. The whole construction of the instrument is such as to enable the surgeon to regulate the pressure with the greatest nicety; making it more or less firmly, and at one or more points, or alternately at different points, as circumstances may seem to require.

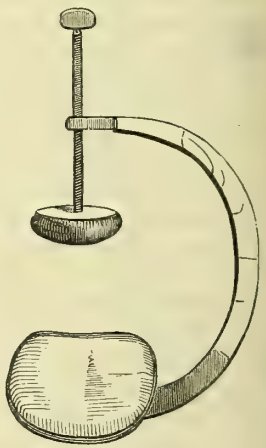
The annexed drawings (figs. 200, 201, and 202) are added for the purpose of enabling the reader to avail himself of the use of other compressors, if the one here described should prove inadequate.

Fig. 200.



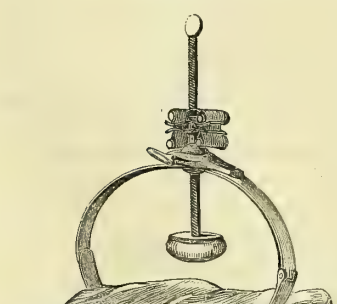
Carte's compressor for the cure of femoral and popliteal aneurism.

Fig. 201.



Hoey's clamp.

Fig. 202.



Carte's circular compressor.

It will generally be well, if the patient is at all intelligent and trustworthy, to instruct him in the use of the instrument, so that he may regulate the compression, according to its effects; lessening it if it be productive of pain, and conversely.

One important principle in the treatment is to compress the artery against the bone, as a point of support; if the pressure be widely diffused it will only serve to embarrass the venous circulation, and to retard the cure. The preliminary treatment should be the same as in the Hunterian operation; and during the progress of the cure the limb should be kept constantly bandaged from its distal extremity

upwards, to support the capillary vessels, and prevent œdema. Strict quietude, both of mind and body, should be observed; the diet should be mild but sufficiently nutritious; and free use should be made of aconite, opium, and acetate of lead, as suggested under the head of the treatment of internal aneurism. If the case is very protracted, and the health is likely to suffer from the consequent confinement, gentle exercise may be permitted in the open air, the instrument being worn several hours in the morning and evening. If any considerable swelling arise in the limb, all treatment must be temporarily suspended, and measures adopted for the relief of the morbid action. To continue the compression under such circumstances would be to jeopard the safety both of the part and patient.

The period at which a cure may reasonably be looked for in this treatment, is subject to much diversity; in some instances compression for a few hours has sufficed to produce this event; in others, and these embrace the greater majority of cases, a number of days are required; occasionally, several weeks elapse; and cases have been reported where the stratification and obliteration of the sac were not completed under two months. As a general rule, it may be assumed that, other things being equal, the cure will be more rapid in proportion to the smallness of the tumor, the tolerance of the part to compression, and the absence of complications.

The results of the treatment of aneurism by instrumental compression are, on the whole, highly flattering, contrasting most favorably with those of the Hunterian deligation. Thus, of 127 cases of compression, rigidly analyzed by Broca, 116 were successful, or in the proportion of 91 to the 100. Altogether, not more than five or six cases have died from the effects of the operation. On the other hand, the statistics of Dr. Norris, of 188 cases of aneurism of the femoral artery, treated according to the Hunterian principle, show a mortality of 46, or in the ratio nearly of one death to three recoveries. The tables of Mr. Inman, given in a previous page, exhibit a similar result.

Besides its indisputable safety, compression has the advantage, if it fail, that it does not preclude the propriety afterwards of a resort to the ligature.

d. DIGITAL COMPRESSION.

Digital compression for the cure of external aneurism has, during the past few years, attracted some attention, both in this country and abroad, but not in so great a degree as its importance demands. Originally proposed as a distinct measure, in 1846, by Professor Vanzetti, of the University of Padua, it was first successfully employed, a year later, by Professor Knight, of New Haven, in a case of popliteal aneurism, in which he cured his patient in forty hours, the compression having been maintained by assistants.

In a communication in the North American Medico-Chirurgical Review for January, 1859, Dr. S. W. Gross has reported the details of a case of femoral aneurism cured by digital compression, and he has accompanied his paper by a statistical report of twenty-two other examples treated by the same method. As this paper treats more fully

of the subject than any other which has fallen under my notice, I shall freely avail myself of its contents.

It is to aneurisms of the extremities that this procedure is mainly, if not exclusively, applicable, as the compression must be made to bear upon some point of the principal artery of the limb. So far as we have been able to ascertain, the brachial has been compressed in three instances only; once for aneurism of the radial artery near the wrist, and twice for arterio-venous aneurism at the bend of the elbow. In all these cases, the pressure was easily maintained, and the cure was effected in a short time. The femoral artery, at different portions of its course, has been the seat of compression nineteen times for popliteal and femoral aneurisms, of which thirteen cases have been cured. The external iliac has been subjected to the same procedure in two cases of inguinal aneurism; in one the pressure was unbearable, and in the other the assistants became so fatigued that it was discontinued. Moreover, it is very difficult in this situation to keep up the pressure, and such cases should, therefore, be excluded.

It has been shown that digital compression has been successful when mechanical compression was unbearable, or had failed, whether alone or conjoined with other means, interrupted or continued, complete or incomplete; it has even, in several cases, been applied by the patients themselves, and in these instances either a cure was effected, or the tumor was so modified that subsequent ligation, or mechanical compression of the artery always resulted in recovery. In no case has it ever been followed by any bad consequences, as is so apt to happen in ligation.

The pain produced by the pressure of the finger is not greater than that caused by the pad of an instrument; should the point of pressure become tender, flour may be sprinkled upon the surface, or a thin, wet cloth may be interposed between the finger and skin. However this may be, suffering, both local and general, may easily be allayed by the free exhibition of anodynes, which should never be neglected.

Of the twenty-three tabulated cases in the paper of Dr. Gross, fifteen were popliteal, with ten cures, and five failures; four were femoral, with three cures and one failure; two were inguinal, both being unsuccessful; and two were arterio-venous, both of which eventuated favorably. Thus, of the twenty-three cases, fifteen were perfectly successful. Of these fifteen cases, the compression in five was employed independently of other means; in five the digital alternated with mechanical compression; in four cases, apparatus had been abandoned, when digital compression effected a cure; and in one the compression was of a mixed character. Of the failures, in six cases digital compression was employed before other means, and in two after trial by apparatus had been abandoned.

An examination of the facts here detailed, will serve to show that digital compression, alternating with the use of apparatus, succeeded in every instance in which it was resorted to, and that, when employed primarily and alone, there were five cures out of seven cases. It seems to me, therefore, that the double method, in which digital and instrumental compression alternate with each other, is the most eligible, not

only on account of its having effected cures in every case in which it has been used, but because it is more easy of application, and gives rise to much less inconvenience to the assistants; in fact, the patient himself may sometimes regulate the pressure with perfect success.

The period required for the cure of aneurism by this method is incomparably shorter than by any other known plan of treatment. Thus, of fourteen cases, the shortest time required for a cure was three and a half hours, the longest being seven days, and the average two days and two-thirds. When compared with the cases cured by instrumental compression, the length of time is most striking. In the London hospitals, according to Mr. Hutchinson, the average time for the cure of twenty-six cases of femoral and popliteal aneurism was nineteen days; while Broca found that the mean duration of treatment in ninety-nine cases was about fifteen days. The greatest objection to digital compression is the difficulty of procuring a sufficient number of competent assistants; but in hospital practice, and in large cities, it will always be possible to do so. Since the publication of Dr. Gross's paper, Vanzetti has reported six successful cases of aneurism by digital compression, thus making twenty-one cures in twenty-nine cases.

e. GALVANO-PUNCTURE.

It would seem that this operation for the radical cure of aneurism was first suggested, in 1832, by Mr. Benjamin Phillips, of London; so far, however, as my information extends, it was not practised by him upon the human subject, and the idea had almost been lost, when, several years ago, it was revived, principally through the agency of Mons. Pétrequin, of Lyons. The operation is founded upon a knowledge of the fact that the galvanic current has the effect, if properly directed, of coagulating the blood as it circulates through the different parts of the body. It is executed by means of two long, slender steel needles, introduced into the aneurismal sac at right angles, and in such a manner as to touch each other, their heads being then connected to the chain of a galvanic battery of moderate tension. The action of the battery is maintained uninterruptedly for a period varying from ten to twenty-five minutes, according to the tolerance of the part, and is usually required to be several times repeated. When the tumor is large the number of needles is increased, and the direction of the current frequently changed, so as to afford a better chance for the formation of clots. As the operation is generally very painful, it is proper that the patient should be placed under the influence of chloroform during its performance. Moreover, as there is danger of seriously charring the integuments, and thus endangering the sac by mortification, the needles should be carefully coated, in a part of their extent, with gum-lac. The success of the procedure is enhanced by compression of the artery above and below the tumor, thereby preventing the clots from being washed away, before an opportunity has been afforded them of becoming consolidated and united with each other and the walls of the aneurism. The after-treatment consists in the application of ice to the part, in perfect quietude, and

in the administration of a full anodyne, to tranquillize the action of the heart and arteries.

Experience has not yet fully determined the value of this mode of treatment. That it is liable to occasional failure is sufficiently evident from the unsuccessful cases that have from time to time been published in England and on the continent of Europe. On the other hand, a considerable number of cases have been reported where its employment was followed by a perfect cure. Of twenty-three cases, collected by Mons. Boinet, in 1851, in which the operation had been practised, nine are stated as having been successful, and thirteen as having been failures. Cases of cure, by this method, of aneurism of the brachial, subclavian, popliteal, and external iliac arteries have been reported by different observers since that period, and, doubtless, others have occurred of which I have no knowledge.

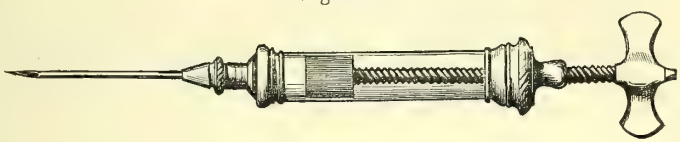
Galvano-puncture is not only painful, but far from being devoid of danger. In some of the reported cases it produced severe inflammation and even suppuration of the sac, followed by great swelling of the limb, together with excessive constitutional disturbance threatening the destruction both of the part and system. The operation is, therefore, a hazardous one, and on this account should never be attempted without due consideration of its consequences, especially when the aneurism is large and situated at, or near to, the trunk. Coupling this circumstance with the want of success of the operation, and the severe pain attending its execution, not to say anything of the danger of producing sloughing in the skin and sac by the action of the galvanic fluid as it is being transmitted from the battery to the tumor, it is questionable whether it is worthy of repetition, notwithstanding the high estimate placed upon it by Pétrequin, Burci, and some other surgeons. The force of this conclusion derives additional support from the facts collected by Mons. Boinet, that in seven of the successful cases, above referred to, compression and ice were employed simultaneously, thus creating a just doubt in the mind of the inquirer whether these agents had not as much to do with the cure as galvano-puncture, if, indeed, not more. I am not aware that this operation has ever been performed in this country, and I trust that it may never be undertaken by any one who is not perfectly familiar with the pathology of the disease.

f. INJECTION.

Attempts have been made in modern times to effect the radical cure of aneurism by the injection of certain fluids with a view of favoring the concretion of the blood, the consolidation of the sac, and the obliteration of the affected artery at the seat of the disease. The practice was originally suggested, early in the present century, by Professor Monteggia, of Milan, who proposed the use of solutions of acetate of lead, tannin, and other astringents, as, in his opinion, well adapted to the purpose, although he never, it would seem, performed the operation. His idea was that, by throwing these substances into the sac, so as to bring them fully into contact with the blood within,

it might be possible to provoke the rapid formation of coagula, and thus effectually arrest the circulation. He supposed, moreover, that the remedy might occasionally be advantageously combined with Brasdor's operation and with compression of the artery upon the cardiac side of the tumor, applied by means of a tourniquet or some other suitable instrument, very much as it is performed at the present day. The suggestion of the Italian surgeon, however, received little, if any, attention, until within a comparatively recent period, when it became the subject of numerous experiments upon the inferior animals, as the sheep, dog, and horse, principally by the French practitioners, who, after having tried various articles, have at length been induced to give a decided preference to a concentrated solution of perchloride of iron in water. The fluid is introduced into the sac by means of a small glass syringe, invented by Mons. Pravaz, of Lyons, and represented in the adjoining sketch (fig. 203), a puncture having previously been made

Fig. 203.



with a delicate trocar and canula, the latter of which is retained in the sac until the injection is completed. The piston of the syringe is moved by means of a screw, so as to enable us to perform the operation more steadily, and without the risk of throwing in more than five or six drops of fluid, that quantity having been found to be quite sufficient for the purpose. As it takes at least half a minute before the blood can be made to coagulate, during which the heart performs not less than thirty-five pulsations, it is necessary to keep the contents of the tumor perfectly quiet, while the injection is progressing, by compression of the artery immediately above and below the aneurism.

The operation is generally productive of severe pain, and as it is liable to be followed by considerable inflammation, it often becomes necessary to make use of antiphlogistic measures, both locally and constitutionally. Its repetition must be governed by circumstances; if everything passes off well, and the sac is promptly solidified, no further interference will, of course, be demanded; but if the reverse be the case, a similar quantity of the solution is thrown in at the end of the third or fourth day, and in the same cautious manner as before. The slightest inflammation of the tumor contraindicates the repetition of the injection.

Since 1853, when Mons. Pravaz first published the results of his experiments on animals, a number of cases have been reported in which injections of the perchloride of iron have been employed in aneurism of different parts of the body, as well as in aneurism of different kinds, as spontaneous, traumatic, and varicose. The arteries upon which the disease occurred were the supra-orbital, carotid, humeral, ulnar, femoral, popliteal, and tibial.

Although a few cures have been effected by this treatment, yet such is the great risk of inflammation, suppuration, and even gangrene, both of the sac and of the surrounding structures, that it is extremely questionable whether any prudent surgeon should repeat it. Of eleven cases, reported by Malgaigne in 1854, it is announced that four had proved fatal, that every one had had bad symptoms, and that only two had been successful. This statement alone, if true, as no doubt it is, is sufficient to condemn the operation as unsafe, and to render its adoption improper in the face of the more unexceptionable methods of ligation and compression. The great desideratum is to discover an article, which, while it shall promptly coagulate the blood, will not cause any severe irritation in the sac and the parts around it. It has been supposed that the acetate of the peroxide of iron might have this effect, but, although at least one successful cure by its use has been reported, yet it has not been tried sufficiently often to enable us to pass any definite judgment respecting its true merits. I should myself have more confidence in the efficacy and safety of the persulphate of iron, generally known as Monsel's salt, than in any other preparation of this metal. It is perfectly destitute, or nearly so, of caustic properties, and is the most prompt and efficient coagulator of the blood of which we have at present any knowledge.

g. MANIPULATION.

Very recently the attention of the profession has been called to a new treatment of aneurism by Mr. Fergusson, of King's College, London. It is termed the method by manipulation. It consists in the forcible squeezing of the tumor, with the intention of breaking up its fibrinous contents in order that some of the fragments thus detached may be carried by the circulation into the distal extremity of the artery, thereby closing its orifice, and so effecting a radical cure. The operation was first performed in 1852, in a case of aneurism of the right subclavian artery, seated partly within and partly on the outside of the scalene muscles, the tumor being about the size of a hen's egg. The sac being emptied of fluid blood, its sides were forcibly rubbed against each other, with the immediate effect of an arrest of pulsation in all the vessels in the limb below. The pulsation, however, returned in about seven hours, and the manipulation was accordingly repeated the next day with a similar result, but it was not until the end of a week that any permanent impression appears to have been made upon the circulation. The tumor now gradually diminished in size, and everything gave evidence of an ultimate cure, when suddenly, seven months afterwards, the patient was seized with violent fever attended with excruciating pain in the part, and died after a few days' illness. Although the axillary artery was found, on dissection, to have been blocked up, the tumor, instead of being obliterated, not only remained hollow, but had extended downwards over the axillary plexus of nerves, the pressure upon which had probably caused the excessive pain which immediately preceded dissolution. In another instance, operated on by the same gentleman, the result was more fortunate, but the cure was not

finally effected until towards the end of the second year. Within the last few years several other cases, also successful, have been reported by other surgeons, among whom I may mention Professor Blackman, of the Medical College of Ohio.

I have not had an opportunity of trying Mr. Fergusson's plan of treatment, but it is, I think, extremely questionable whether it ought to be repeated. The great objections to it are, first, the uncertainty of the operation, even when the distal end of the artery has been blocked up; secondly, the tardiness of its progress; and thirdly, the danger that some of the detached clots may find their way into the brain, as in aneurism of the neck, thus causing fatal apoplexy, as has already happened in several cases in which the method has been tried. If employed at all, therefore, it should, in my judgment, be restricted to aneurism of the subclavian, axillary, femoral, and popliteal arteries, in the early stage of the disease, before the tumor has acquired any considerable bulk.

h. VALSALVA'S TREATMENT OF INTERNAL ANEURISM.

Internal aneurisms, inaccessible to the ligature and compression, occasionally recover under a regular and systematic course of treatment designed to promote the coagulation of the blood in the interior of the tumor, by increasing the plastic properties of this fluid, and quieting the action of the heart and arteries. This treatment, which was originally suggested by Valsalva, and which still bears his name, consists in the strict observance of the recumbent posture, perfect mental quietude, the occasional abstraction of blood from the arm, and the use, simply, of a sufficiency of food and drink to prevent starvation. When, writes Morgagni, Valsalva had taken away as much blood as was deemed necessary, he diminished the diet "more and more every day, until only half a pound of pudding was taken in the morning, and in the evening half that quantity, and nothing else except water, the weight of which was also regulated, and which he medicated with what is called quince-jelly, or the lapis osteocolla, ground down into a very fine powder. After the patient had been sufficiently reduced by this method, so that he could scarcely raise his head from the bed, to which, by Valsalva's direction, he was confined, the quantity of aliment was day by day increased, until the strength that was necessary to enable him to get up had returned." Most modern writers, in speaking of this method, recommend, as important adjuvants, the internal exhibition of digitalis, acetate of lead, and opium, with a view of insuring more speedily and effectually the ends proposed by Valsalva and his followers; the digitalis being given to diminish the number and force of the pulsations of the heart and arteries, the lead to increase the coagulability of the blood, and the opium to allay pain and nervous irritability.

We have no account of the number of cases of aneurism successfully treated by Valsalva by this method, but that he cured several persons with it is a conjecture warranted by the statements of Morgagni, by whom it was first described. What is still more to be regretted is the fact that we are equally ignorant in regard to the

results obtained by others. Notwithstanding this, however, it seems to me that the treatment is worthy of more attention than it has hitherto received, especially of late years, when so little has been said and done concerning it. The question, however, arises whether it might not be beneficially modified, so as to render it better adapted to the attainment of the object which it is designed to accomplish. In reflecting upon the subject, some years ago, it occurred to me that, instead of bleeding and starving the patient, upon which so much stress was laid by the Italian practitioner, the end might be more easily and speedily obtained by the abandonment of the lancet altogether, and the substitution of nutritious food, in as dry, concentrated, and non-stimulant a state as possible. If the object be to procure a more plastic and coagulable condition of the blood, to promote the formation of clots, this can certainly be done much more advantageously, as well as in a much shorter time, by such a course than by one of an opposite character. Repeated bleeding and a light farinaceous diet, comprising a little pudding and jelly, taken twice a day, must, unquestionably, render the blood very thin and watery, and therefore less disposed to fibrinization, the very reverse of what is really needed for the cure of aneurism. It would be more in accordance, then, with sound physiology and practice, to refrain from venesection entirely, and to put the patient upon a moderate allowance of food, as a few ounces of equal parts of hashed meat and bread, potato, or rice, at dinner, with a suitable quantity of stale bread, toast, or cracker at breakfast and supper; tea, coffee, and all other drinks, excepting water and lemonade, as well as all kinds of condiments, being scrupulously avoided. The patient should be kept perfectly at rest, in the recumbent posture, with the mind in as tranquil a state as possible, while the system should be steadily maintained under the free use of the tincture of aconite, or of veratrum viride, conjoined with acetate of lead and opium, or, what would probably be better, the persulphate of iron. The pulse should be brought down, if practicable, to forty or forty-five beats in the minute, and the chances of success would be all the greater if a prolonged state of somnolency could be maintained, the patient sleeping the greater part of the twenty-four hours. Protracted constipation of the bowels should be aimed at; if purgatives become indispensable, they must be of the mildest character, as all irritating and griping articles are sure to do harm by exciting the action of the heart and arteries.

The length of time during which this treatment should be continued must vary according to the circumstances of each individual case, and no attempt should, therefore, be made to reduce it to any general principles. It certainly might, with judicious management, be kept up, without detriment, for several consecutive weeks. As the patient emerges from it, he should return, but most gradually and cautiously, to his accustomed diet, except that, for a long time afterwards, it should be free from all stimulants; nor should he, for many months, take any, except the most gentle, exercise. In short, everything should be done calculated to second nature in her efforts to effect the cure thus auspiciously begun, and which, other things being equal, will

always be so much the more likely to take place if the aneurism be small and of recent standing.

i. GENERAL MEDICAL TREATMENT.

Persons affected with aneurism often experience, as stated elsewhere, great pain and other suffering, both from the inflamed condition of the tumor and from the pressure which it exerts upon the surrounding parts. In aneurism of the thoracic portion of the aorta and of the arteries at the root of the neck, the pain and dyspnœa are sometimes excessive, demanding prompt and vigorous measures for their relief. If the patient be plethoric, and the pulsation in the tumor uncommonly active, the loss of twelve, fifteen, or twenty ounces of blood will be useful, but care must be taken not to carry the venesection too far, otherwise injurious reaction may take place, and thus aggravate the suffering. When the tumor is accessible, or situated externally, whether partly or entirely, the blood is often most advantageously abstracted directly from the part by means of leeches, which, even when employed only in small numbers, generally afford immense relief, both as it respects the pain and the difficulty of breathing. Topical depletion is always extremely serviceable in inflamed aneurism, and it is here also that fomentations and refrigerating lotions, simple or medicated, come into play, frequently exerting their happiest influence. Our choice of these remedies must be governed in these, as in other cases, by the tolerance of the part and system. Attention to position and rest must be enjoined, and strictly carried out. The bowels are not neglected, but great care is taken to avoid active purgation, experience having shown that such a procedure always produces undue excitement of the vascular and nervous systems. Anodynes are always well borne in these cases, and should be administered in full doses, either alone or in union with diaphoretics and expectorants, according to the state of the skin and of the respiratory organs. Any complications that may arise during the progress of the disease, whether self-existent or dependent upon the irritation produced by the pressure of the tumor, must be treated upon broad general principles.

FALSE ANEURISM.

A false aneurism consists, as already stated, of a pulsating tumor formed external to the affected artery, and, consequently, without any aid from its tunics, which are altogether excluded from its composition. A number of affections, of a very opposite character, have been described under this appellation, and the result has been, as might have been anticipated, much confusion. To remedy this evil, I shall limit myself, in the account which I am about to give of the disease, to two varieties of false aneurism, the arterial and arterio-venous, the tumor in each being strictly circumscribed, and connected, in the former, with an artery, and, in the latter, both with an artery and a vein. What is called a diffused aneurism is, in fact, as stated elsewhere, no aneurism at all, but merely an accumulation of blood in the subcutaneous and

intermuscular cellular tissue, which, although it may be somewhat condensed around it, yet does not, in reality, in the true meaning of the word, constitute a proper aneurismal sac.

The most common cause of the spurious arterial aneurism is external injury, as a stab or puncture, such, for example, as is so often inflicted in venesection at the bend of the arm, permitting the blood to escape in small quantity into the surrounding cellular substance, which is soon condensed into a firm, circumscribed, pulsating cyst, often not exceeding the volume of a pullet's egg, and of a rounded or ovoidal figure. Similar effects occasionally follow the laceration of an artery, as that of the ham, from the sudden and forcible extension of the leg, from the intrusion of the sharp end of a broken bone, or from ulcerative action.

Sometimes the aneurismal formation is secondary; that is, consequent upon the partial cicatrization of the wound, the interposed or overlying plasma being unable to withstand the impulse of the blood, and so yielding before it. However induced, all the tunics of the artery are at once perforated, and the blood is sent abroad into the circumjacent cellular tissue, in the manner and with the effect just stated.

The sac in this variety of aneurism, formed originally, as has just been remarked, out of the neighboring cellular tissue, is speedily strengthened by the effusion of plastic matter, so that, in time, it often acquires considerable thickness with an extraordinary degree of density. I have seen a number of cases where the cyst, even at an early stage of the disease, was of a very firm, compact, fibroid consistence, and of a white, glistening appearance, its substance being convertible, by dissection, into several distinct strata. The tumor, particularly in cases of long standing, generally contains well organized concretions, arranged in the same concentric manner as in the true sacculated aneurism, and presenting a similar hue and consistence. The course, symptoms, and termination of this disease do not require any special notice, as they do not differ, in any respect, from the ordinary form of the affection.

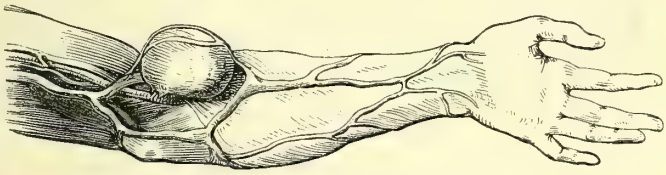
The *treatment* may be conducted by compression, or, this failing, by ligature. The compression is applied, as in true aneurism, upon the cardiac aspect of the tumor, four, six, or eight inches from it, with the instrument already described, retardation of the circulation and gradual obliteration of the sac being steadily kept in view. If an operation becomes necessary, a free incision is carried across the tumor, and a ligature applied immediately above and below, as in an ordinary wounded artery. The tumor may then be dissected out, or, as some prefer, though I think improperly, it may be left to the influence of the absorbents. As a preliminary step, a tourniquet is cast around the limb to control the circulation in the affected vessel. Although one ligature is occasionally sufficient to effect a cure in this disease, yet I would strongly advise the ligation of the vessel both above and below the swelling, lest trouble should arise on account of the recurrent circulation, and thus lead to the necessity of doing at a subsequent period what ought to have been done in the first instance. The memo-

rable case of Anel affords an excellent illustration of the fact that an aneurism of this kind, especially when seated at the bend of the arm, may occasionally be cured by a ligature applied just above the tumor.

1. The *arterio-venous* aneurism, originally described under the name of varicose aneurism, consists of a tumor which is situated, as the term implies, between a contiguous artery and vein, so as to admit of a ready interchange of the two kinds of blood. The most common site of the lesion is the bend of the arm, where it is usually caused by a puncture in bleeding, in which the overlying vein, usually the median basilic, is completely transfixed along with the superficial wall of the brachial artery. A similar accident may, of course, happen in any other part of the body, from a stab or wound of a contiguous artery and vein, as between the femoral, or between the aorta and cava. Sometimes, again, the aneurism forms in consequence of ulceration, beginning in one vessel and gradually extending to the other, and so eventually establishing a communication between them through the intervention of a sac.

In whatever manner the aneurism is formed, the cyst is usually of small size, seldom exceeding, and not often equalling, that of a pullet's

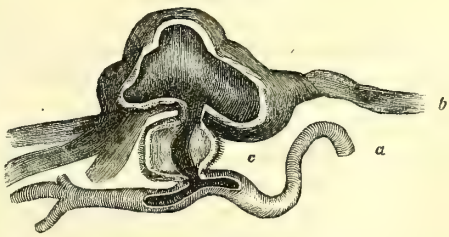
Fig. 204.



Varicose aneurism; external appearance.

egg (figs. 204 and 205). It is composed partly of condensed cellular substance and partly of plastic matter, the latter always greatly predominating, as is shown by its extraordinary thickness as well as density, which closely resembles that of the fibrous tissue. The tumor although it is seldom the seat of much pain, interferes more or less with the functions of the affected limb. The opening of communication being always very small, the blood rushes into it with a peculiar noise, not unlike that produced by the buzzing of a fly in a paper box, or the purring of a cat. Sometimes it is of a whirring character, similar to the prolonged articulation of the letter R. It is perceived both by the ear and finger, and is so extraordinary that it may be regarded as pathognomonic of the nature of the affection. The sac rarely contains any well-formed fibrinous concretions, and, on laying it open, it is often

Fig. 205.



Varicose aneurism; internal view. *a*. The artery. *b*. The vein. *c*. The intermediate cyst.

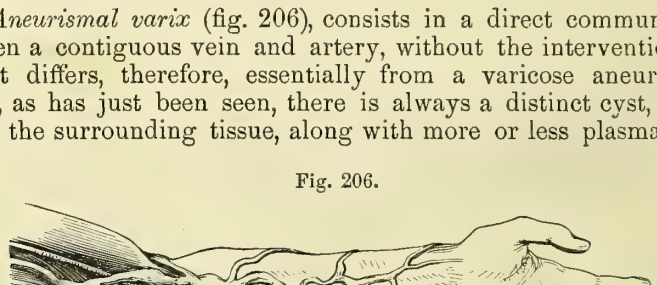
found to be perfectly smooth and white, like the interior of an artery. Manifesting little disposition to increase, it sometimes remains stationary for years, but seldom, if ever, undergoes spontaneous cure, or terminates in rupture, ulceration, or gangrene.

When the tumor is very small, not exceeding the volume of a filbert or a pigeon's egg, and does not occasion any suffering, interference is neither desirable nor proper; it is merely an inconvenience, and had better be let alone. The reverse, however, is usually the case, and then the same treatment will be required as in spurious aneurism connected with an artery only; that is, the vessel is tied just above and below the tumor, which is left to undergo absorption, lest its removal should give rise to phlebitis in consequence of the unavoidable injury inflicted upon the affected vein.

When the disease occurs in connection with the aorta and cava, operative interference will, of course, be out of the question; nor can anything be hoped for from medical treatment. The case, in fact, is irremediable, and will be sure, in time, to cause death, either by the gradual giving way of the sac, or by exciting violent irritation, pain, and constitutional disorder.

2. *Aneurismal varix* (fig. 206), consists in a direct communication between a contiguous vein and artery, without the intervention of a sac; it differs, therefore, essentially from a varicose aneurism, in which, as has just been seen, there is always a distinct cyst, formed out of the surrounding tissue, along with more or less plasma. The

Fig. 206.



Aneurismal varix.

affection is altogether so unlike aneurism, whether true or spurious, that it is surprising it should ever have been included under the same category.

The cause of aneurismal varix—a disease first described by Dr. William Hunter, in 1756—is usually some external injury, such as a puncture, transfixing a vein and piercing the contiguous wall of an underlying artery. Hence, the lesion is most common at the bend of the arm, between the median basilic vein and brachial artery, in consequence of venesection. It may, however, occur between other veins and arteries lying in juxtaposition with one another, either through accident, or from the effects of ulceration commencing in the coats of one vessel and gradually perforating those of the other. The orifice of communication is usually small, and of a circular shape, with well-defined margins, although there is, in this respect, no particular uniformity. The adhesion between the two vessels is generally very firm, as well as of considerable extent, and it is well

that it should be so, otherwise there would be constant danger of the connection giving way. Owing to the incessant interchange and commingling of the two kinds of blood, the vessels gradually undergo important changes, the most interesting of which are that the vein assumes the properties of an artery, and the artery those of a vein. The vein, from the impetuous manner in which the arterial blood is sent into it at each stroke of the heart, becomes greatly enlarged both above and below the abnormal opening, at the same time that it acquires an extraordinary degree of density, and pulsates with unusual force. In the arm, where I have met with several instances of this disease, I have found the dilatation of the vein extend, on the one hand, nearly as high up as the axilla, and on the other, as low down as the middle of the forearm. The artery, which now receives black blood, but not in any large quantity, is eventually transformed into a soft, thin, flexuous tube, which, possessing rather the properties of a vein than those of an artery, pulsates but feebly under the finger.

The formation of this disease is generally attended with some degree of pain and swelling, along with interstitial effusions, causing the integuments to pit slightly on pressure. The parts below the seat of the lesion are imperfectly nourished, and hence they usually feel somewhat cold and numb until the circulation is fully re-established through the agency of the collateral branches. As the blood passes from one vessel into the other it produces a peculiar jarring sensation and a singular whirring noise, not unlike the purring of a cat, which often extends to a great distance along the dilated vein, now performing the vicarious functions of an artery, and which may be regarded as the pathognomonic signs of the disease.

In the cases of this lesion which have fallen under my observation, the inconvenience has been so trifling that I have not considered it proper to resort to operative interference. In one instance the patient had an aneurismal varix on the right arm from venesection performed upwards of fifteen years previously, and, although he was a blacksmith and a hard working man, it did not in the slightest degree interrupt his occupation. When trouble arises so as to render treatment necessary, relief may be attempted by compression of the brachial artery, as in varicose aneurism; this failing, the artery should be exposed by a careful dissection, and a ligature applied both above and below the orifice of communication, all disturbance of the vein being avoided.

SECT. VII.—ANEURISM OF PARTICULAR ARTERIES.

ANEURISM OF THE INNOMINATE ARTERY.

The relative frequency of aneurism of the innominate artery does not admit of any definite statement, owing to the great discrepancy in our statistics. Thus, in 179 cases of spontaneous aneurism, excluding those of the aorta, analyzed by Lisfranc, the innominate is mentioned only four times, while the carotid is mentioned seventeen times and the subclavian sixteen. In Mr. Crisp's table of 551 cases, embracing

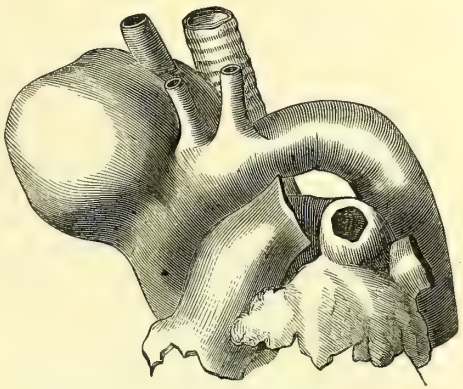
234 of aneurism of the aorta, the innominate was affected in 20, the carotid in 25, and the subclavian in 23. The disease, as in the other arteries, is much more common in men than in women, and in the laboring than in the higher classes of persons. The greatest number of cases occur between the thirty-fifth and fifty-fifth year. It may exist by itself or be associated with aneurism of the arch of the aorta, the carotid, or subclavian. The extent of involvement varies from the slightest increase of the normal size to an enormous tumor, either tubular, fusiform, or sacculated in its character. Whether every portion of the vessel is equally liable to be affected is uncertain, but observation has shown that the disease is sometimes situated so low down as to become identified with the arch of the aorta, while at other times it is so high up as to extend into the carotid and subclavian. Occasionally, it is limited to the middle of the vessel, each extremity retaining its healthy appearance.

Symptoms.—Aneurism of the innominate artery usually begins as a small tumor at the right sterno-clavicular articulation, between the trachea and the inner edge of the mastoid muscle, immediately above the inner third of the clavicle. In some cases, the patient is conscious of the moment when the accident takes place, there being a feeling as if something had given way while he was shaken by a violent paroxysm of coughing or engaged in lifting a heavy weight. The tumor, at first, is generally very small, probably not exceeding the size of a little almond, of a rounded or ovoidal shape, distinctly circumscribed, and slightly movable on pressing the finger firmly down into the hollow at the top of the sternum. It is not long, however, before it increases in volume; commonly, in fact, it grows rapidly, soon attaining a large bulk, extending upwards into the neck, and laterally towards each side, but especially towards the right, where there is least resistance. As it progresses, it gradually pushes forwards the mastoid muscle, and even the sterno-clavicular articulation, forming thus a large prominence, beating and throbbing violently beneath the skin. Now and then, upon escaping from the chest, the tumor ascends high up into the neck, perhaps nearly on a level with the larynx, and when this is the case it is not uncommon for it to present a constricted, hourglass-like appearance, as if a cord had been drawn tightly across its middle.

Effects on Neighboring Structures.—The effects which the tumor exerts upon the neighboring parts (fig. 207) are chiefly of a mechanical character, and must be considered with reference, first, to the vessels of the superior extremity, neck, and head; secondly, the trachea and œsophagus; thirdly, the aorta, heart, and vena cava; fourthly, the nerves of the neck and chest; and, lastly, the sternum, clavicle, and ribs.

The pressure of the tumor upon the subclavian has the effect of weakening the force of the circulation at the wrist, and in some cases even of entirely suppressing it. Occasionally, the pulse is extremely irregular, beating not only more feebly than that in the opposite limb, but ceasing to act synchronously with it, the blood hitching and halting, as it were, on its way to the hand. Any tumor may of course produce such an effect, and hence there is nothing characteristic in it.

Fig. 207.



Aneurism of the innominate artery, proving fatal by bursting into the trachea.

In aneurism of the aorta, the signs of enfeebled circulation are, as a general rule, most strongly marked on the left side, owing to the fact that the tumor, from its proximity to the left subclavian, exerts a more direct and controlling influence upon that vessel than it does upon the right subclavian. The pulsation of the carotid and its branches is sometimes diminished both in innominatal and aortic aneurism, but more frequently in the former than in the latter. It is, however, a rare occurrence in either case, and therefore of no diagnostic value.

Compression of the veins at the root of the neck, as the innominate, jugular, and subclavian, but especially the first, by impeding the return of blood to the heart, will occasionally cause *œdema* of the right side of the head, face, and eyelids, and of the corresponding limb, extending as low down as the hand and fingers. The occurrence, however, is uncommon, and it is probable that it may be due, in part, to injury sustained by the right lymphatic duct, situated just behind the tumor.

As the tumor enlarges, it necessarily encroaches more and more upon the trachea, pushing it over towards the left side, and at the same time somewhat backwards. When the displacement is considerable, the patient will breathe with difficulty, and will occasionally be unable to lie down, owing to the mechanical obstruction to the introduction of the air. Should the tumor be situated unusually low, or be of extraordinary size, it may compress and flatten the right bronchial tube. Dyspnœa from both of these causes, however, is less frequent in aneurism of the innominate artery than in aneurism of the arch of the aorta, owing to the fact that, in the latter disease, the tumor enlarges most in a backward direction, its progress forwards being interfered with by the sternum and clavicle. Displacement of the œsophagus is sometimes present in both affections, but not as often as has generally been supposed. When existing in a high degree, it may seriously embarrass the function of deglutition, especially the passage of solids.

When the aneurism occupies the inferior portion of the artery, but more especially when it extends downwards into the chest, it follows, as a necessary consequence, that it must press upon the aorta, heart, and vena cava, pushing them out of their natural position, and perhaps seriously diminishing their capacity. The particular effect which such compression must exert cannot always be diagnosticated, but it is reasonable to conclude that it will manifest itself in disordered circu-

lation, especially in tumultuous and confused cardiac action, enfeebled pulse, and more or less dyspnœa. An aortic aneurism will of course be more likely to produce such a state of things than an innominatal.

Pressure of the tumor upon the *nerves* of the neck and chest induces not only pain and cough, but gives rise, in many cases, to severe dyspnœa and dysphagia, the two latter symptoms being not always, by any means, exclusively dependent upon the displacement and flattening of the trachea and œsophagus. On the contrary, they sometimes exist in a very marked and even in an aggravated degree when there is apparently very little, if any, compression of these tubes. We must therefore look for some other explanation of these phenomena, and the most plausible one that suggests itself is that they are due to the compression of the pneumogastric, phrenic, laryngeal, and sympathetic nerves, which are thus disqualified for carrying on their appropriate functions, that, namely, of receiving and transmitting, in a regular and harmonious manner, their peculiar influence to the organs to which they are distributed, and in which they play so important a part in the natural state.

The *dyspnœa*, although not a constant symptom, is yet often enough present to render it one of great importance. It varies in degree from the slightest change in the natural respiration to the most frightful embarrassment, in which the patient is almost suffocated, and unable to maintain the recumbent posture. It is of course most severe and distressing when the tumor has acquired an unusual bulk, compressing the pneumogastric and other nerves, and so interrupting their healthy action. It may be constant, or paroxysmal, coming on at irregular intervals, lasting for some time, and then gradually receding, though perhaps at no time wholly absent.

The *dysphagia* is also variable in degree, being at one time very slight, and at another so severe as almost to prevent the patient from swallowing any kind of food, whether solid or fluid. In the more aggravated cases, the difficulty is constant, and the patient finally dies exhausted from starvation. It is a remarkable fact that in almost every case of dysphagia this symptom is preceded by dyspnœa.

The *pain* which accompanies the disease is most severe in the right side, in the situation of the tumor, from which it runs in various directions, particularly along the right side of the neck and head, and the corresponding side of the chest, shoulder, and arm. Occasionally, though rarely, it is also felt keenly on the opposite side. It is generally of a dull, aching, or gnawing character, and is often so excessive as to compel the use of large doses of anodynes for its temporary subjugation.

Cough is occasionally present, probably in one case out of every three or four, but it is less common than in aortic aneurism, and is a symptom of no special value. It is evidently produced by the pressure of the tumor upon the laryngeal nerves, and varies much in frequency and severity in different cases and under different circumstances. From the same cause there is sometimes an altered state of the voice.

When the tumor is very large, and extends outwards and downwards, so as to compress the cervical and brachial plexus of nerves, it may induce partial *paralysis*, as well as, in some cases, partial loss

of sensation, in the upper extremity. Such an occurrence, however, is extremely rare, as the sac seldom attains such a magnitude.

There is sometimes marked alteration in the *respiratory sounds;* more frequently, however, in aortic than in innominatal aneurism. The breathing, when affected, is disposed to be stridulous, or wheezing, and this is sometimes the case even when the patient is in the erect posture. The respiratory murmur is seldom affected in innominatal aneurism, obviously because the tumor encroaches but little, if any, upon the lungs; it is only when it extends deep down into the thorax that it is likely to produce such an effect, and then, but not otherwise, there will, also, of necessity, be dulness on percussion of the chest, over the site of the disease. Both these phenomena are more frequent in aortic aneurism, because the tumor in that disease always encroaches more upon the lungs than in the former case.

Finally, the pressure of the tumor occasionally induces serious disease in the neighboring *bones*, as the sternum, clavicle, and first rib, the contiguous portions of which are liable, in the first instance, to be displaced, then to become carious, and ultimately to be wholly absorbed. In some cases there is complete dislocation of the sterno-clavicular joint.

Diagnosis.—After what has just been said, it will be easily understood that the diagnosis of innominatal aneurism must often be extremely difficult, its situation at the root of the neck rendering it liable to be confounded with aneurism of the arch of the aorta, the carotid, and subclavian. Then, again, certain tumors—fatty, fibrous, and encysted—sometimes form at the inferior portion of the cervical region, and receiving an impulse from the innominate, or even from the aorta itself, may thus simulate the disease in question. Finally, I have occasionally encountered great difficulty in determining the diagnosis of disease occurring in this situation in consequence of abnormal pulsation either of this vessel, or of the aorta, apparently dependent upon an anemic condition of the system, or neuralgia of the arteries, and so violent as to communicate a severe shock at every contraction of the left ventricle of the heart to the innominate and its two branches, the carotid and subclavian. The embarrassment, in these cases, is increased if, superadded to the pulsation at the root of the neck, there is an unusual quantity of fat, or some solid growth, and the sharp thrill so common in the arteries of anemic subjects.

On the whole, the most reliable diagnostic signs of aneurism of the innominate are, first, the situation of the tumor at the right sterno-clavicular joint, immediately above the inner third of the clavicle, where it forms a distinct, well-marked prominence; secondly, stoppage of aneurismal beat, thrill, and bellows' sound, by pressure upon the carotid and subclavian; and, thirdly, unnatural weakness of the pulse at the right wrist, with pain and œdema on the corresponding side of the neck, shoulder, and arm. In aortic aneurism, the tumor seldom projects sensibly above the sternum; certainly not before it has attained a considerable bulk, and then it is situated rather in the middle line than on the right side; the arterial pulse, if affected at all, is weakest on the left side, and there also the œdema and pain are most conspicuous; the dyspnœa, dysphagia, cough, stridulous respiration,

and change of voice are more frequent than in the innominatal disease; and compression of the carotid and subclavian produces no diminution in the sounds of the tumor.

Prognosis.—The prognosis of brachio-cephalic aneurism is extremely unfavorable. The disease, it is true, may last for a considerable time, but this is very rare; in general, it progresses very rapidly, and soon reaches a fatal crisis, the tumor either opening externally, into the trachea, or into the chest, or else, as is commonly the case, wearing out the patient by constitutional irritation, asphyxia, or inanition. No instance of spontaneous cure has ever been known to occur in this disease.

Treatment.—The treatment of aneurism of the innominate has hitherto been most unsatisfactory. Owing to the short and stunted character of this vessel, and the close proximity of the aneurism to the arch of the aorta, deligation on the Hunterian principle is, of course, altogether impracticable, and hence the only resource is either to treat the disease upon the plan of Valsalva, or to tie the carotid and subclavian at the distal side of the sac, according to the method originally suggested by Brasdor. The treatment of the Italian surgeon holds out but little encouragement, the disease generally going on from bad to worse until it reaches its fatal crisis, despite the most abstemious course of dieting, rest in the recumbent posture, the use of the lancet, and the exhibition of digitalis, opium, and acetate of lead, to promote the formation of clots. With the exception of Mr. Luke's case, there is hardly an instance upon record in which it was followed by any ultimate benefit. Squeezing the tumor, if practicable, would certainly not be justifiable, as the detached clots might, and probably would, fall into the aorta, and thus cause serious, if not fatal, results on the spot, from mechanical obstruction to the circulation. The operation of Brasdor has been performed in a number of cases, which I shall place before the reader in tabular form.

In only one case have the carotid and subclavian arteries been tied simultaneously. The patient died at the end of six days. At the autopsy, the left carotid and right vertebral arteries were found occluded, showing that the circulation of the brain had been carried on by the left vertebral alone. Rossi was the operator.

In three cases, the carotid and subclavian have been successively tied, as recommended by Mr. Fearn, of Derby, England.

No.	Operator.	Sex.	Age.	Carotid ligature.	Subclavian ligature.	Remarks.
1	Fearn	F.	28	Aug. 30, 1836	Aug. 2, 1838	Died from pleurisy 3 weeks after second operation. The aneurismal sac was found filled with dense, organized coagula, except a channel for the passage of blood the size of the artery.
2	Wickham	M.	55	Sept. 25, 1839	Dec. 3, 1839	The aneurism increased, and burst with mortal hemorrhage 63 days after the second operation.
3	Malgaigne	M.	—	March, 1845	Oct. 17, 1845	Four days after the operation, the tumor increased rapidly in size, the tumefaction became diffused, and the patient died on the 7th Nov. At the autopsy, the sac could not be dissected; it was confounded with the muscles; in other words, the aneurism was diffused.

In three cases, the subclavian alone has been tied, with a result of two deaths and one recovery.

No.	Operator.	Sex.	Age.	Result.	Remarks.
1	Dupuytren	M.	40	Death	The subclavian was tied immediately above the clavicle. The tumor diminished, but the pulsations continued. The patient died on the 9th day, from exhaustion following cough and secondary hemorrhage. At the autopsy, aneurism of the subclavian was found, with dilatation of the innominate and aorta.
2	Laugier	M.	57	Died	The vessel was tied immediately above the clavicle. The patient died from asphyxia, one month after the operation. The operator had supposed the case to be one of subclavian aneurism.
3	Wardrop	F.	45	Recovered	The patient, cured of an aneurism occupying the upper part of the innominate, died two years after the operation, of a new aneurism formed above the first, apparently on the same trunk.

The carotid alone has been tied in eleven cases, of which two were cured, and the rest died.

No.	Operator.	Sex.	Age.	Result.	Remarks.
1	Evans	M.	30	Recovered	The tumor still existed, with constant pulsation, at the end of a year. The next year, the sac suppurated, and discharged much pus. At the expiration of nine years, there was no sign of any increase in the affection.
2	Mott	M.	55	Died	After the operation, the tumor was much diminished; but the patient died of asphyxia seven months after the operation.
3	Dohlhoff	F.	—	Died	The aneurism was much improved, but the patient died from the effects of the ligature of the carotid upon the brain. At the autopsy, the aneurism was found occupying the external side of the innominate near its bifurcation; it was as large as the fist, and filled with fibrinous clots.
4	Key	F.	61	Died	The patient died a few hours after the operation from its effect upon the brain. The vertebral arteries were found smaller than natural.
5	Vilardebo	M.	70	Died	The patient was a negro. He died on the twenty-first day after the operation. At the autopsy, two aneurisms were found; one of the inferior extremity of the right primitive carotid, the other of the trunk of the innominate.
6	Fergusson	M.	56	Died	The patient died of pneumonia on the seventh day. The tumor had diminished, and, at the autopsy, was found nearly filled with firm laminated coagula.
7	Hutton	M.	47	Died	The size of the tumor and the pulsations diminished after the operation, but the sac inflamed, suppurated, and opened into the trachea, and the patient died on the sixty-sixth day.
8	Porta	—	—	Died	The patient died forty hours after the application of the ligature. The autopsy showed an arterial dilatation of the innominate and its two branches, without true aneurism.
9	Campbell	M.	48	Died	The tumor began to disappear after the vessel was ligatured, but the patient died of pneumonia on the nineteenth day.
10	Morrison	M.	42	Recovered	The patient recovered from the operation, and died suddenly twenty months afterwards. The cause of death is not given. At the autopsy, the right carotid was found dilated in the form of a sac, and filled with a resisting fibrinous deposit. The brachio-cephalic trunk and curve of the aorta were found larger than usual, and the walls were diseased, but these vessels were not aneurismatic.
11	Wright	M.	70	Died	The patient died on the eighty-eighth day from hemiplegia. The tumor was solidified by fibrin, a canal leading through it to the subclavian. Four abscesses were found in the right hemisphere of the brain.

A careful examination of the above cases affords the following conclusions concerning the deligation of the primitive carotid for the cure of innominatal aneurism:—

1. It reduces the volume of the tumor. Thus, in the case of Mr. Evans, of Derby, in 1828, although the aneurism was as large as a walnut, it entirely disappeared in a little upwards of a month. In Dr. Mott's case, in 1829, it was of the size of a pigeon's egg, and disappeared in twenty-six days.

2. The operation leads to fibrinization of the contents of the sac. These changes, which are due, not to arteritis, but to remora of the blood, were well displayed in the cases reported by Mr. Morrison, of Buenos Ayres, in 1834, and of Mr. Fergusson, of London, in 1841. In the former, the innominate artery was reduced to at least one-half its previous bulk; in the latter, the tumor was nearly filled with firm clots.

3. The operation does not involve any *special* risk. In five of the cases it was followed by death, not, apparently, from any agency of the aneurism, but because of the danger which naturally follows the ligation of the common carotid, for whatever purpose. Thus, in the case of Mr. Key, in 1830, the patient died of syncope, produced by coarctation of the left carotid and vertebral arteries. In two other instances, one by Fergusson, in 1841, and the other by Campbell, of Montreal, in 1845, death resulted from pneumonia. In Hutton's case, the cause of death was inflammation and ulceration of the sac, also a very common effect of the operation for carotid aneurism, whether the ligature be placed above or below the tumor. In the interesting case of Professor Wright, of Montreal, in 1855, the patient died of abscesses of the brain, the first example of the kind on record after Brasdor's operation, although severe cerebral symptoms often succeed the ligation of the common carotid for accidents and tumors of the head, eye, and face.

4. The operation has not been productive of a long after-life; chiefly, perhaps, because the cases demanding it were nearly all inherently hopeless, from being associated with organic disease of the aorta, or of this vessel and of the heart. Distinct evidence of this fact existed in at least seven of the cases; in the rest no accurate examination was made. The influence of such complications is shown by the results which followed Brasdor's operation in aneurism of the root of the carotid unmixed with any other lesion. Of five cases of this kind, three completely recovered; one was successful so far as the aneurism was concerned; and in only one was there no improvement.

5. The operation lengthens life if perilled by rupture of the sac, or pressure on the windpipe. In fact, here is its great triumph. In the case of Professor Wright, although the man was in imminent danger before the operation, yet he survived it eighty-eight days. The mean duration of life after deligation of the carotid, under ordinary circumstances, is about four months and a half.

6. The operation has occasionally failed to effect any local improvement. This result followed in three of the cases, in consequence of a want of fibrinization of the contents of the sac.

The facts above stated, deduced mainly from the paper of Professor

Wright, in the Montreal Journal of Medicine, clearly point, as that gentleman justly remarks, to a division of cases in regard to the applicability of the operation. 1. The most suitable cases are those of uncomplicated innominatal aneurism, being akin to the pure carotid form, the sac, which is confined to the part of the vessel near the bifurcation, springing from the left segment of the artery, and not coexisting with degeneration of its tunics or cardiac disease. 2. Those imperatively requiring it are such as entail imminent danger from external rupture of the tumor or from other causes. 3. The most favorable cases are aneurisms proceeding from the left segment of the artery, because then the introduction of blood into the sac is most effectively impeded, as it is derived from the current destined for the vessel which is tied, whereas, when the aneurism is dextro-lateral, the same benefit cannot be afforded, as the supply is furnished by the subclavian. Next to this situation, the most preferable, anatomically, would be the origin of the tumor from the anterior circumference of the vessel. 4. The less advantageous cases are those in which the external tumor extends towards the middle of the clavicle, for this occurrence denotes such an engagement of the subclavian as must effectually counteract any benefit derivable from ligature of the carotid. When the swelling is equal on each side of the innominate, or symmetrical, then the only hope of a certain stasis of blood would be afforded by tying both branches. 5. The cases contra-indicating the operation are those having complications with aortic aneurism, or serious disease of the heart, unless excepted by extreme urgency.

ANEURISM OF THE COMMON CAROTID ARTERY.

Aneurism of the carotid, although less frequent than that of some of the other arteries, especially the popliteal and femoral, has, nevertheless, always attracted much attention, for the reason, probably, that its exposed situation in the neck has afforded unusual facilities for its observation and study. However this may be, its history is perhaps, on the whole, better understood than that of aneurism of any other artery. The relative frequency of the disease has been placed before the profession by several writers. Thus, in the table compiled by Lisfranc, comprising 179 cases of aneurism, exclusive of those of the aorta, 17 refer to the carotid, the subclavian having been affected in 16, the axillary in 14, the femoral in 26, and the popliteal in 59. In the table of Mr. Crisp, the carotid is stated to have been engaged in 25 cases out of 551, embracing 234 of the aorta, giving thus a considerably larger proportion than that of the French author.

Spontaneous aneurism of the carotid is more frequent in men than in women, but not by any means in the same relative proportion as spontaneous aneurism of the other arteries. Thus, in 34 cases analyzed by Dr. Norris, 27 were males, and 7 females, being in the ratio of nearly four of the former to one of the latter; a ratio which is altogether unequalled by that of any other vessel. An idea formerly prevailed that the disease occurred here with nearly equal frequency

in both sexes, but such a conclusion is totally at variance with the facts of the case.

The disease, although occasionally observed at an early *age*, is most common between the thirtieth and the sixtieth year. It occurs with nearly equal frequency on both sides, and, in fact, sometimes exists simultaneously in both arteries. No occupation is exempt from it. One would suppose, from reflecting upon the peculiarity of their pursuits, that acrobats, who are in the habit of making such violent and long-continued use of their necks, often sustaining enormous loads upon their heads, would be particularly prone to carotid aneurism, and yet the disease is hardly known among them.

The *site* of carotid aneurism is variable. Sometimes the tumor is situated very low down in the neck, close to the origin of the vessel; on the other hand, it may be seated high up, near its bifurcation. In the great majority of cases, however, it will be found to be between these two points, at or near the middle of the artery; usually rather above than below.

Symptoms.—The tumor, when first observed, is generally quite small, perhaps not exceeding the size of a filbert, and of an irregularly globular, rounded, or ovoidal shape. The patient, upon being questioned as to the history of the case, usually expresses his ignorance as to the time of its occurrence, though occasionally he is rendered conscious of it by a peculiar stabbing sensation in the neck, or a feeling as if something had suddenly snapped asunder. Commonly the surgeon is not consulted until the tumor has made considerable progress, and acquired the volume of a hen's egg, or of a small orange, the patient, perhaps, having all along supposed that the swelling was merely an enlargement of some of the cervical ganglions. A careful inspection, however, promptly reveals its true character, its pulsation, thrill, and bellows' sound affording unmistakable evidence of its close and intimate arterial connection. Pressure upon the cardiac side of the aneurism, by stopping its circulation, arrests these symptoms, and causes a sensible diminution of the size and consistence of the tumor, while pressure upon its distal side produces an opposite result. As long as it is small, the tumor may readily be moved about, and even raised out of its bed, especially if it be grasped with the thumb and forefinger during the relaxed condition of the sterno-mastoid muscle; as it augments in volume it becomes more fixed in its position, and is eventually rendered almost, if not entirely, stationary.

The symptoms of carotid aneurism are altogether of a mechanical character, being such as arise from the pressure of the tumor upon the neighboring parts; hence, their gravity is generally in proportion to the volume of the morbid growth. In the earlier stages of the disease, there is either no functional disturbance whatever, or it is so insignificant as not to attract any special attention; by and by, however, as it progresses, the tumor necessarily encroaches more and more upon the delicate and important structures of the neck, thus occasioning congestion of the brain by retarding the return of blood in the jugular vein, numbness, pain, and cough, by compressing the cervical, pneumogastric, and phrenic nerves, and difficulty of respiration, and, perhaps,

even of deglutition, by bearing against the trachea and œsophagus. The surface of the swelling, at first perfectly natural, becomes gradually indurated and inflamed, the subcutaneous veins are unusually conspicuous, and the neck is stiff, distorted, and almost immovable. The greatest enlargement of the tumor is generally in the direction of the median plane, as the resistance is much less there than externally, under the edge of the sterno-cleido-mastoid muscle.

Diagnosis.—Notwithstanding that the symptoms of carotid aneurism are usually well-marked, cases, nevertheless, occur in which they are so obscure as to render it extremely difficult to determine the diagnosis, even after the most careful and patient investigation. The affections of the neck which are most liable to be confounded with carotid aneurism, and to render the discrimination doubtful, are diseased lymphatic ganglions, abscesses, encysted tumors, goitre, dilatation of the internal jugular vein, and aneurism of the innominate artery and arch of the aorta.

Enlargement of the *lymphatic ganglions* of the neck is most common in young subjects, before the age of twenty, whereas aneurism of the carotid is rarely met with until after thirty; moreover, it is almost peculiar to scrofulous persons, while aneurism occurs in all classes of individuals, the strumous and the non-strumous. In aneurism the tumor is generally well-defined; its surface is smooth and uniform, and the swelling heaves and throbs, as if it were alive. In glandular enlargement, there is generally a chain of diseased ganglions, either scattered about in different parts of the neck, or stretched along the inner border of the sterno-cleido-mastoid muscle; the tumors feel hard, and may, with a little care, be easily separated, not only from each other, but from the carotid artery, so as to get entirely beyond the reach of its pulsation.

Aneurism of the carotid artery has sometimes been mistaken for *abscess;* the tumor has been punctured, and the patient has speedily perished of hemorrhage. Such an error, of course, implies great carelessness, and could hardly happen at the present day when our means of diagnosis are so much more perfect than formerly. The discrimination must be determined on general principles. If there be an abscess, the history of the case, conjoined with the unnatural heat and redness of the part, the rapid progress of the swelling, the febrile disturbance, and the absence of the characteristic pulsation, thrill, and bellows' sound, will be sufficient to distinguish it from aneurism of the carotid artery.

Encysted tumors, usually containing a serous or sero-sanguinolent fluid, are liable to form at the front and sides of the neck, most generally in connection with the thyroid gland, but sometimes independently of it, in the cellular tissue beneath the muscles. They can usually readily be distinguished by their slow growth and fluctuating feel, the absence of pain and pulsation, and, when they are attached to the thyroid gland, by their obeying the movements of the larynx in the act of deglutition. If, after a careful examination of their history, any doubt exists as to their real nature, the only resource will be the cautious introduction of the exploring needle.

Goitre is liable to be mistaken for carotid aneurism only when it spreads laterally over the neck, so as to overlap the carotid, and receive its pulsation. It is certainly not possible to commit any error of diagnosis in the more ordinary and simple forms of the disease. Confusion is most apt to arise when aneurism and goitre co-exist, or when, as occasionally happens, the latter disease is developed uncommonly rapidly, and is attended with considerable local distress. Ordinarily, goitre forms in early life, at a period when aneurism is extremely infrequent; its progress is generally tardy, several years elapsing before it attains any material bulk, and is subject to occasional interruptions, and even total suspension, whereas aneurism generally advances rapidly and steadily, the symptoms proceeding from bad to worse, until it attains its crisis. Another important criterion is the fact that goitre is almost peculiar to females, whereas carotid aneurism occurs by far most frequently in men. But the most satisfactory diagnostic signs are, first, that, in goitre, the tumor obeys the movements of the larynx, whereas, in aneurism, it remains stationary, however strong the efforts at deglutition; secondly, that, in the former, the tumor may be drawn away from the vessel, raised up or pushed to one side, while in the latter the vessel follows it, forming, as it does, a part of it; and, lastly, that in goitre the general health rarely suffers, even when the tumor is of large bulk, whereas in aneurism it is always more or less impaired, especially when it has reached such a stage as to be likely to occasion embarrassment in regard to the discrimination between the two affections.

A dilated condition of the internal *jugular vein* may simulate aneurism of the carotid artery. The deception will be more likely to happen if the vein receives a pulsatory movement from the heart, or from the carotid, as when the artery is overlapped by the vein. The venous tumor may generally be distinguished by its softness and compressibility, by its situation, which is commonly just above the sternum, and rather behind than in front of the mastoid muscle, and by the circumstance that its motion is more of an undulatory, wave-like, or tremulous character, than shock-like and vibratory, as in aneurism. Superadded to this is the fact that the venous swelling may be readily effaced by pressure applied to its distal extremity, whereas, in aneurism, the pressure, to produce any appreciable effect of this kind at all, must be applied to the cardiac extremity of the tumor, and then it will result only in a diminution, not in complete obliteration.

Finally, a carotid aneurism may be confounded with aneurism of the *brachio-cephalic artery* or of the arch of the aorta, especially if it be situated low down in the neck. When this is the case, the difficulty may be very great, if not insurmountable. The best diagnostic sign with which I am acquainted, and one that will rarely fail us, in such an emergency, is afforded by our ability to insinuate the point of the forefinger between the top of the sternum and the lower extremity of the aneurism, while the head is being bent powerfully forwards, so as to relax as fully as possible the mastoid muscles. If this can be done, the probability is that the tumor is connected with

the carotid; otherwise we may conclude that it is formed by the innominate artery, or by the arch of the aorta.

Progress.—The progress of carotid aneurism, although usually rapid, is not so always. The annals of surgery contain several cases where the disease remained almost stationary for a considerable number of years; in one instance as many as fourteen. A spontaneous cure sometimes occurs, but such an event must necessarily be extremely rare. The tumor, if allowed to go on unchecked, eventually—generally at a period varying from three to twelve months—destroys life either by excessive constitutional irritation, hemorrhage, gangrene, pneumonia, or asphyxia. When seized by ulceration, it may burst either externally, or it may open into the pleura, the anterior mediastinum, the trachea, or one of the bronchial tubes.

Treatment.—The treatment of carotid aneurism is generally conducted according to the Hunterian principle of ligating the supplying vessel at the cardiac side of the tumor; and, fortunately, as the disease is ordinarily situated rather high up, this may commonly be done without any very great difficulty, especially in the earlier stages of the affection, before the swelling has attained much bulk. When the tumor is of great size, or located at the inferior part of the neck, we may be compelled to adopt the method of Brasdor, and tie the carotid on the distal side of the aneurism, trusting that the blood in the tumor, no longer finding an outlet, will gradually coagulate, and so effect its obliteration. The fact is, this artery, owing to the total absence of collateral branches, is peculiarly adapted to this operation, and it is well that it should be so, seeing that, if it were otherwise, we should be obliged to resign many of the more severe cases of carotid aneurism to their fate, without any attempt whatever at surgical interference. It is obvious, from the relations of the vessels and nerves of the neck to the tumor, that compression, now so much employed in the treatment of aneurism of the lower extremity, cannot be brought in play here, the parts being intolerant of the requisite manipulation, to say nothing of the obstruction which it would occasion to the return of the blood in the internal jugular vein, which, being dammed up in the brain and the sinuses of the dura mater, might speedily induce apoplexy, and other serious cerebral symptoms, endangering the patient's life. When the tumor is of extraordinary bulk, rendering ligation of the carotid impracticable at any point, our only hope, faint though it be, is the success of general measures, particularly Valsalva's method, for experience has conclusively proved that no benefit is to be expected from the ligation of the innominate artery, as originally proposed and practised by Dr. Mott. The deligation of the terminal branches of the carotid might be tried with a better prospect of success, but this also would be likely to fail, owing to the numerous offsets of the external carotid, which, unless included in separate ligatures, would continue to transmit the blood from the tumor with sufficient force and activity to maintain its circulation unimpaired, and so inevitably frustrate the intentions of the operation.

When the tumor is unusually voluminous, or even of moderate size, but situated very low down, overlapping and compressing the

trachea, the symptoms may be so urgent as to demand the operation of laryngotomy, to save the patient from impending asphyxia. Such an event must, however, be very uncommon.

A very interesting case of carotid aneurism has been related by Dr. Robertson, of Edinburgh, in which he performed an operation after the tumor had burst into the œsophagus. The swelling was situated so low down that he was compelled to ligate the vessel only half an inch above its origin from the innominate artery. Notwithstanding these unfavorable circumstances, the patient made an excellent recovery, the ligature coming away on the seventeenth day.

The operation of tying the carotid is easy enough in ordinary cases, but when the aneurism is large, or the neck very short and fat, it is one of the most difficult and trying undertakings in surgery. The principal accidents likely to attend it are the inclusion of the jugular vein and pneumogastric nerve in the ligature, and the wounding of some of the smaller vessels of the neck, which it is sometimes more difficult to find and secure than the carotid itself.

Mortality and other Effects.—Of the mortality of the operation for carotid aneurism, a tolerably accurate estimate may be formed from the data now before the profession. Of 21 cases mentioned by Mr. Crisp, 10 were successful, and 11 fatal. In 5, the artery was ligated at the distal side of the tumor, and of these, 3 recovered, the other 2 being only somewhat benefited. Of the 11 fatal cases, 5 were lost by hemorrhage, 2 by inflammation of the sac and artery, and 1 by spasm of the glottis, the cause of death in the remaining 3 being doubtful. The table of Dr. Norris contains an analysis of 38 cases, in which the carotid was tied for aneurism, including 4, however, in which the disease was found, after the operation, not to have been connected with the artery. Of these cases, 22 recovered, and 16 died. The cause of death is mentioned in only 12 of the cases; in 5 it was hemorrhage, in 2 inflammation of the sac, in 2 apoplexy and congestion of the brain, in 1 cerebritis, in 1 spasm of the glottis, and in 1 exhaustion.

In 6 of the 38 cases, the aneurism suppurated, and either burst or was laid open; of these, 4 died and 2 recovered. In one instance the opening in the sac occurred four months, and in another nearly eight months after the operation. In one fatal case the tumor burst into the pharynx fifteen days after the deligation of the artery, and in another case, which, however, recovered, it had discharged some of its contents into the mouth prior to the operation.

Return of *pulsation* in the tumor, after the operation, was noted in nine of the thirty-eight cases; in one the pulsation never ceased entirely for two months, and in another it continued for upwards of four months.

The detachment of the ligature occurred, in 13 cases, before the twentieth day; in 7, between the twentieth and thirtieth, and in 1 on the thirty-third day. The time, in the remaining cases, was not observed.

In seven of the cases, analyzed by Dr. Norris, there was a mistake in the diagnosis, as was proved on the dissection, for all the patients died. In four, the disease consisted of different kinds of tumors; in

two, of aneurisms supposed to be abscesses; and in one, of an aneurism of the vertebral artery. The examples of mistaken diagnosis include the celebrated case of Mr. Liston, of a lad, nine years of age, who had a tumor on the right side of the neck of two months' standing, which, although seated over the carotid, was entirely free from pulsation, except along the track of that vessel. Under the conviction that it was merely an abscess, a bistoury was introduced, the removal of which was followed by a gush of arterial blood to the amount of four ounces. The bleeding being arrested by closing the wound with the twisted suture, the common carotid was tied on the following day, October 21st, close to its origin from the innominate artery. On the 3d of November, the arterial hemorrhage suddenly recurred, but was suppressed by plugging the wound with lint; it, however, again broke forth, and proved fatal on the 5th, that is, fifteen days after the operation. Although the ligature had retained its hold upon the artery, the proximal end of the vessel was found to be quite patulous, no attempt having been made at the formation of a coagulum. The probability is that, as Mr. Liston has suggested, the tumor, in this remarkable case, was originally a scrofulous abscess, a part of the wall of which was formed by the carotid; this, becoming ulcerated, finally gave way, and thus sent its contents into the cyst inclosing the matter.

Injury to the internal jugular vein has been a cause of death in several cases of ligation of the carotid. In an instance in which Barovero included this vessel with the artery, the patient died on the sixty-ninth day of gastric fever. Mr. Crisp met with a case where a surgeon tied the internal jugular vein instead of the carotid; the patient was a child, and the error was not discovered until after death.

Very serious cerebral and pulmonic symptoms occasionally follow the ligation of the carotid artery, and are among the principal sources of the mortality from this operation. The effects which the operation produces upon the *brain* have been elucidated both by experiments upon the inferior animals and by observations upon the human subject, and manifest themselves in various ways and at different intervals. Their full importance, however, was not known until after the publication of the researches of Mr. Chevers, of London, in 1845, to whom the profession is greatly indebted for the valuable light which he has thrown upon a subject which, up to that period, had been entirely overlooked. In the one hundred and twenty-five cases analyzed by Dr. Norris, in which the common carotid was tied either for aneurism, wounds, or erectile tumors, more or less severe cerebral disturbance occurred in thirty. Some of these cases recovered completely, some got well of the operation, but remained afterwards in a crippled condition, and some, perhaps the majority, died, the period of death varying from a few hours to several months.

There is no uniformity either in the character or in the manifestation of the cerebral symptoms. Sometimes they come on immediately, or at all events, within a few hours after the deligation of the vessel; while at other times, and perhaps most generally, they do not appear until the end of several days, weeks, or even months. Their access is usually sudden, but occasionally so gradual and imperceptible as to keep

the patient in ignorance of it until it is discovered accidentally. The most frequent symptoms, on the whole, are convulsions and paralysis. The former are sometimes general, but much oftener partial, affecting, for example, one arm, a leg, or one side of the face; in some cases, there are merely spasmodic twitches, or irregular, involuntary movements. The paralysis occasionally exists on the side of the affected artery, but in most cases it occurs on the opposite side, when it sometimes pervades one-half of the body, as in hemiplegia, though generally it is only of limited extent, being confined, perhaps, to the face, tongue, throat, fauces, eyelid, hand, arm, leg, or thigh. Sometimes there is dimness of vision, with or without dilatation of the pupil; a feeling of drowsiness, somnolency, stupor, or coma; dizziness, vertigo, or headache; noise in the ears or partial deafness; delirium, either alone or conjoined with paralysis or convulsions; difficulty of deglutition; dyspnœa; a sense of coldness, or coldness and numbness; and various other symptoms, mostly of an anomalous, nervous character. Occasionally these effects rapidly disappear, but in general they are more or less persistent, and in some cases they remain up to the moment of the death of the patient. In some instances, inflammation of the brain, or of the brain and its envelops, supervenes, either soon after the deligation of the vessel, or at a more or less remote period.

How are these phenomena produced? Are they caused merely by an inadequate supply of blood to the brain, or are they the consequence solely of a loss of equilibrium in the cerebral circulation? To these questions it is of course impossible to return anything like a definite answer. It would seem probable, from the free anastomosis which exists between the branches of the internal carotid arteries, on the one hand, and between these arteries and the vertebral, on the other, that they could not be occasioned by a mere want of blood, inasmuch as these vessels are capable of furnishing the organ with an abundant supply of that material for the purpose of carrying on its healthy functions. Nevertheless, it is not unlikely that unpleasant effects may and do follow the sudden withdrawal of a certain quantity of blood from the brain, resembling those produced by copious bleeding at the arm, or by a smart concussion of the brain. In some instances, it is reasonable to conclude that they are the result of the inclusion of an important nerve; while in another class of cases, as when several weeks or months elapse before their supervention, they would seem to be the direct consequence of inflammation. Under the latter circumstances, dissection reveals softening of the cerebral substance and effusion of serum, or of serum and lymph, in the ventricles and upon the surface of the brain.

The most constant *pulmonary* effects occasioned by the ligation of the carotid artery are cough, bronchitis, and inflammation of the pulmonary tissue. Cough is not only a very frequent occurrence, but often one of great severity, rendering it sometimes extremely difficult to check it. It generally comes on soon after the operation, in fits of a violent spasmodic character, in which the patient is in the deepest distress, looking and acting as if he were about to be suffocated. Its duration is variable; sometimes lasting only a few hours, while at

other times it continues, as a prominent symptom, for days together. When very severe, it may occasion hemorrhage in the wound, by re-opening some of the vessels.

It is not easy to determine how this cough is induced. From the fact that it often follows immediately upon the operation, it is not unlikely that it may arise from the inclusion in the ligature of some nervous filament, which thus sets up irritation in the mucous membrane of the air-passages, especially of the larynx and trachea, causing an effect not dissimilar from that awakened by the sudden intromission of a drop of water into the windpipe. That the effect must be somewhat of this character would seem probable, when we reflect upon the spasmodic and uncontrollable nature of the cough which generally characterizes the attack. At other times, the cough may be purely sympathetic, or, what is more likely, may be caused by the compression of the filaments of the tri-splanchnic nerve, which are so abundantly distributed through the coats of the arteries, especially those about the neck and chest.

The effects which the ligation of the carotid exerts upon the bronchia and lungs set in at various periods after the operation, and are denoted by the usual rational and physical signs. On dissection, the mucous membrane of the former is found to be of a reddish color, either uniformly, or in patches, greatly engorged with blood, and covered with pus, or pus and lymph. The lungs are abnormally vascular, loaded with black blood, more or less hepatized, or solidified at one point and softened at another. Blood and pus are sometimes contained in the anterior mediastinum; the pleura has been known to be the seat of extensive effusions; now and then there are traces of inflammation of the larynx and trachea; and occasionally, though rarely, the examination reveals the existence of pericarditis and endocarditis. When the inflammation of the respiratory organs is at all considerable, the blood drawn during life generally evinces a buffed, if not also a cupped appearance.

Such being the effects which are liable to follow, probably in one case out of every four or five, in the brain and lungs, in consequence of the deligation of the carotid, it is obvious that they should be carefully looked for, in order that proper measures may be adopted for their prompt and efficient removal the moment they arise. Much may be done, in most instances, by way of prevention, by a judicious preparatory course, consisting of venesection, purgatives, light diet, and repose of mind and body, which cannot fail to contribute materially to the protection both of the brain and lungs. The operation having been performed, these organs are most sedulously watched, the least indication that arises being met by appropriate means; and in this way, the case is safely conducted to a favorable issue. If the patient be pale and faint, alcoholic stimulants, cautiously and judiciously administered, will be of service; cough and convulsive symptoms are treated with anodynes and antispasmodics, particularly morphia; and inflammation is controlled by the lancet, leeches, blisters, purgatives, aconite, and antimonials.

ANEURISM OF THE EXTERNAL CAROTID.

Spontaneous aneurism of the external carotid is perhaps still more uncommon than that of the internal carotid; its history, consequently, is involved in obscurity. The situation of the tumor just below the angle of the jaw, its throbbing, pulsatile character, and its gradually increasing volume, would serve to distinguish it from ordinary growths in this portion of the cervical region.

ANEURISM OF THE OPHTHALMIC ARTERY.

Aneurism of this artery is rare, both as a traumatic and as a spontaneous affection. The former is usually caused by severe injury, and is apt to be followed by excessive enlargement of the structures of the orbit with protrusion of the eye. A number of cases of spontaneous aneurism of this artery are upon record, in only a few of which, however, the nature of the disease has been verified by dissection. Aneurism by anastomosis is also sometimes met with. The progress of aneurism of the ophthalmic artery is usually slow, and the symptoms are always characteristic. The proper remedy is ligation of the common carotid artery as early in the disease as possible, before there is any serious structural change in the parts. In anastomotic aneurism, a cure has occasionally been effected by injection of perchloride of iron; and recently several cases have been successfully treated by digital compression of the carotid.

ANEURISM OF THE INTERNAL CAROTID.

Aneurism of the internal carotid has been observed only in a few instances, its deep situation at the side of the neck and its exemption from ossific and fatty degeneration serving to protect it from this disease. The diagnosis must necessarily be obscure, and is generally only determined after death. The London and Edinburgh Monthly Journal of Medicine and Surgery, for 1842, contains the particulars of a remarkable case of aneurism of this vessel observed by Mr. Syme. The patient, a woman aged sixty, had had a tumor for about five months in the throat, in the usual situation of abscess of the tonsil. It had attained about the size of a large walnut, exhibited a diffused appearance when viewed through the mouth, and pulsated in a strong and characteristic manner in every portion of its extent. The ligation of the common carotid artery diminished, but did not completely arrest, the throbbing. The woman died in thirty hours after the operation without any assignable cause. Had a less careful surgeon had the management of this case, he might probably have punctured the tumor under the supposition of its being an abscess, and thus instantly hurled his patient out of existence, much to his own discredit and that of the profession.

ANEURISM OF THE VERTEBRAL ARTERY.

Aneurism of this artery, both spontaneous and traumatic, is extremely uncommon, a circumstance no doubt due to the deep situation of this vessel and to its freedom from ossification. In two very interesting cases of this disease, described by Ramaglia, of Naples, and South, of London, the diagnosis was so obscure that the true nature of the disease was not detected until after death. In both the common carotid was tied without, of course, any benefit. In the former, which was an example of traumatic aneurism, situated behind the left ear, the operator, finding that the deligation did not arrest the pulsation, removed the ligature and treated the case upon general principles, death occurring soon after. In the other instance, in which the carotid artery could be distinctly traced over the tumor, this vessel was also tied under the supposition that it was the seat of the swelling. The tumor, however, rapidly increased, and in a fortnight after caused death by bursting into the trachea. Dissection showed that it was an aneurism of the vertebral artery, situated between the transverse processes of the fourth and fifth cervical vertebræ.

Möbus, a German surgeon, has reported a case of aneurism of the vertebral artery, the result of a wound of the neck, in which a cure was effected by compression and the use of ice.

ANEURISM OF THE SUBCLAVIAN.

Statistics prove that aneurism of the subclavian is nearly as frequent as that of the carotid. In Lisfranc's table the popliteal comes first, then the femoral, next the carotid, and then the subclavian, the latter having suffered in 16 cases out of 179. In the table of Mr. Crisp, comprising 295 cases of external aneurism, the subclavian was engaged in 23 and the carotid in 25. The disease is more frequent in the right artery than in the left, in men than in women, and in the laboring than in the higher classes. The period of life during which most of the cases occur is between the thirtieth and fiftieth years.

The disease may affect any portion of the artery, but is most frequent beyond the scalene muscles, a short distance before it becomes merged in the axillary. The form of the aneurism is generally globular or ovoidal, but cases are observed in which it has a singularly compressed appearance; and, on the other hand, it may be remarkably lobulated, especially when it is very capacious, and extends deeply among the surrounding structures, which thus indent its surface. Its volume is seldom very large, unless it becomes diffuse, when it may attain an enormous magnitude, reaching nearly up to the angle of the jaw, pushing out the clavicle, overlapping the trachea, displacing the scapula, pressing backwards against the ribs and spine, and dipping into the cavity of the chest so as to force down the lung and impede respiration.

As the tumor enlarges, it necessarily encroaches upon and compresses the neighboring parts, causing more or less pain, œdema,

difficulty of respiration, dilatation of the veins of the neck, chest, and upper extremity, and a feeling of numbness and sometimes even partial paralysis. Originally small, deep seated, circumscribed, indolent, and movable, it generally steadily augments in volume, approaching, as it does so, nearer and nearer to the surface, loses its defined shape, becomes the seat of incessant pain, and at length contracts firm adhesions to the surrounding structures, identifying itself, as it were, with them. Examined with the ear and hand, it readily imparts to them the peculiar beat, thrill, and bellows' sound so characteristic of aneurism in other regions.

Diagnosis.—The diagnosis of subclavian aneurism is sometimes extremely difficult, and several cases have been reported in which the vessel was ligated where no disease of the kind existed. The affections with which it is most liable to be confounded are aneurism of the innominate artery or arch of the aorta, abscesses, and various kinds of tumors, solid and encysted, benign and malignant. As these lesions are of frequent occurrence in this region, it is impossible for the surgeon to be too cautious in his examination of cases involving questions of diagnosis.

The history of the tumor and its situation at the side of the neck, just above the clavicle, generally afford important data in regard to the diagnosis. If the patient is under thirty years of age, it may almost certainly be assumed that the disease is not spontaneous aneurism, as there are probably not three well-authenticated cases on record in which the subclavian was thus affected at this early period. Aneurism of the innominate is situated lower down, and approaches nearer to the middle line, than aneurism of its subclavian division; and in aneurism of the aorta, the tumor, although it may extend into the neck, rarely projects as far above the clavicle as in the lesion in question; certainly not in its earlier stages, when alone a correct diagnosis can be of any avail in an operative point of view. If the case be seen soon after its commencement, before the tumor has attained any considerable bulk, a very good idea may often be formed as to the precise portion of the artery that is affected by it. Thus, for example, if the aneurism occupies the space immediately exterior to the sterno-cleido-mastoid muscle, and manifests a tendency to extend upwards into the neck, and downwards in the direction of the axilla, it may be assumed that it is seated upon the outer portion of the vessel, beyond the scalene muscles. On the other hand, it may be concluded that it is connected with the inner portion of the artery, if the tumor is placed under cover of the mastoid muscle, and is gradually making its way over towards the median line, thus leaving the inferior triangle of the neck clear. It may be added that in subclavian aneurism the tumor is less liable to encroach upon the windpipe and œsophagus than in innominatal and aortic aneurism, and hence there is generally much less cough, dyspnœa, and dysphagia in this than in the other affections. It is only, in fact, when the tumor is of great bulk, or when it happens, from the peculiarity of its position, to exert much pressure upon the pneumogastric, phrenic, and laryngeal nerves, that any serious symptoms of this kind will be likely to arise.

Progress.—Subclavian aneurism is always a serious disease, a spontaneous cure, although possible, as several cases upon record testify, being an extremely rare occurrence. In general, the disease progresses until it attains a certain point of development, when it terminates fatally, either by ulceration and hemorrhage, or by the induction of constitutional irritation. The sac may open externally, a not uncommon event, especially when it is invaded by gangrene; or it may burst into the pleura, lungs, trachea, or œsophagus; in either case, death takes place either instantly or within a short time after the tumor has begun to give way. There are several cases on record in which the aneurism pointed in the axilla and on the shoulder, having completely eroded some of the upper ribs and the body of the scapula, the latter being scooped out so as to form a kind of bed for the accommodation of the sac.

Treatment.—The treatment of subclavian aneurism has hitherto been exceedingly unsatisfactory, and there is no probability, judging from the deep situation and intricate relations of the tumor, that much benefit will ever accrue from any mode of management that may be devised for its relief. The plan of Valsalva, varied in every possible manner, has signally failed in every instance except a few, and no one seems now disposed to place any confidence whatever in its efficacy. Acupuncturation and electricity, from which so much benefit had at one time been anticipated, have likewise disappointed expectation. Some time ago a case was reported in which a cure was alleged to have been effected by galvano-puncture, but the example is a solitary one, and the procedure is of too problematical a character to merit serious attention. Of what resource, then, can the surgeon avail himself in this unfortunate class of cases? Ligation of the affected artery is not only difficult, under any circumstances, in consequence of the position of the tumor and the intricacy of its anatomical relations, but is frequently absolutely impracticable on account of the diseased state of the artery, rendering it unable to support the ligature. Shall he adopt the operation of Dr. Mott, and secure the innominate, of which the subclavian, on the right side, is one of the main divisions? Here, again, difficulties meet him in every direction, for even if he should be so fortunate as to get his ligature around the vessel, which, however, is by no means always the case, he will find, by consulting the history of the operation, that every instance in which it has been performed has had a fatal termination. Nothing, therefore, is to be gained from that procedure. In short, the Hunterian principle of operation is hardly applicable to any case of subclavian aneurism. On the right side, we are not only obliged to encounter, as just stated, great difficulties in reaching the innominate artery, but in throwing a ligature around the vessel we effectually cut off a large and important supply of blood to the brain, thus greatly enhancing the dangers of the case.

The innominate artery has been tied for the cure of subclavian aneurism in eight cases, the results of which are here subjoined in tabular form.

Operator.	Date.	Age.	Sex.	Disease.	Result.	Remarks.
Mott	1818	57	M.	Subclavian aneurism	Died on 26th day	Artery tied half an inch below its bifurcation; ligature separated on the 14th day; hemorrhage on the 9th, and again on the 23d day; death on 26th day. Ulceration of the artery, and want of occlusion.
Graefe	1822		M.	Subclavian aneurism	Died on 67th day	Ligature came off on 14th day; death from hemorrhage.
Norman	1824				Died	
Arendt	1824			Subclavian aneurism	Died on 8th day	Cause of death, inflammation of the aneurismal sac and of the pleura and lungs.
Hall	1830	45	M.	Subclavian aneurism	Died on 5th day	Artery morbidly adherent; dilated, soft, and friable; torn, in the attempt to separate it, at two points, between which the ligature was applied; copious hemorrhage during operation; plugging of the wound; participation of the aorta and carotid in the disease.
Bland	1832	31	M.	Subclavian aneurism	Died on 18th day	Ligature placed around artery near its bifurcation; hemorrhage on the 17th day, proving fatal on the 18th; innominate and carotid closed by solid clots; the subclavian still open.
Lizars	1837	30	M.	Subclavian aneurism	Died on 21st day	Ligature separated on 17th day; pleuritis; death caused by repeated hemorrhages; twenty ounces of coagulated blood at the root of the neck; arteries imperfectly closed.
Hutin	1842	26	M.	Hemorrhage after ligature of subclavian	Died in 12 hours	Tied for secondary hemorrhage, after subclavian had been secured for wound of the axillary.

All the cases in the above table, except one, proved fatal from hemorrhage of the wound, caused by the want of occlusion either of the ligated artery, or of the carotid and subclavian. It will be observed that Graefe's patient survived upwards of two months. I purposely exclude from the table the cases which are usually referred to as having occurred in the practice of Dupuytren and Bujalski, not considering them as sufficiently well authenticated to entitle them to a place in it. I also reject from it several reported cases in which the operation of ligating the innominate artery was commenced but not completed.

Dr. Peixotto, of Portugal, tied the innominate artery in 1851, on account of secondary hemorrhage from the common carotid, which had been ligated three weeks previously. The ligature, however, which was a precautionary one, was not tightened, but applied merely so as to flatten the vessel. The patient made a good recovery. Such an operation can hardly be regarded as a true case of deligation of the innominate artery. The cure was doubtless effected by the ligation of the other vessel.

Mr. Key, of London, in a case of aneurism of the subclavian, found it impracticable to apply a ligature to the innominate, in consequence of the volume of the tumor, and the diseased condition of the latter vessel. The patient was seized soon after the operation with symptoms of pulmonary distress and exhaustion, and died on the twenty-third day.

The operation of ligating the innominate artery is one of no inconsiderable difficulty, even in the dead subject, but in the living

the perplexity is greatly increased by the proximity of the aneurism, by the presence of glandular swellings, and, above all, by the manner in which the parts at the root of the neck are matted together by plastic deposits, rendering it thus exceedingly troublesome to separate them. These embarrassments were experienced in a striking degree by Dr. Hall, of Baltimore; he had great difficulty in isolating the vessel, and, in attempting to do so, tore it at two points, ligating it afterwards between them. Hemorrhage occurred at the time, but was checked by plugging the wound. Another obstacle to successful deligation is disease of the vessel, consisting either in a morbid dilatation, or in a softened and lacerable condition of its coats. Unforeseen difficulties were present in more than one-fourth of the cases in which ligation of the artery has been attempted, compelling the operators to desist, notwithstanding their great dexterity and profound knowledge of the anatomy of the neck.

Mr. Porter, of Dublin, in 1831 attempted to tie this artery on account of aneurism, but was obliged to desist in consequence of its diseased condition. The tumor, nevertheless, gradually disappeared, and the patient, a man forty-seven years of age, finally recovered.

Dr. Hoffman, of New York, in a case of subclavian aneurism in a man, aged sixty-three, cut down upon the innominate artery with the design of applying a ligature to it, should he be unable to ligate the subclavian; but he found the vessel so much enlarged that it was deemed inexpedient to proceed any further, and the patient was accordingly abandoned to his fate. The operation was performed on the 26th of October, 1839, and death occurred on the 19th of January, 1840.

The proposal to ligate the innominate originated with Mr. Allan Burns, from a conviction that the circulation in the head and upper extremity could be maintained without the agency of this vessel, and that it could be easily enough exposed by tracing it downwards towards the aorta, by a careful and patient dissection, the head being at the time bent well back. It remained, however, for Dr. Mott, in 1818, to put the suggestion to the test of experiment upon the living subject; and, although the operation had an unfavorable issue, the man dying, as has been already stated, on the twenty-sixth day, yet we cannot but admire the genius which could plan, and the intrepid skill which could execute, so daring and brilliant a feat. The case was one of subclavian aneurism above the clavicle, and the design had been to apply the thread to the latter vessel, but, after exposing it on the tracheal side of the scalene muscle, it was found that its tunics were too much diseased to bear the pressure of the ligature, and he accordingly tied the innominate in its stead.

In a case of subclavian aneurism, Dupuytren tied the axillary artery under the pectoral muscles. Hemorrhage, or, rather, oozing of blood, commenced on the fifth day, and the patient died on the ninth.

In another case the same operation was performed by Pétrequin. The tumor continuing to pulsate, the sac was punctured, and eight or nine drops of a solution of the perchloride of iron were injected, the brachio cephalic trunk being compressed during the injection, and for

ten minutes afterwards. The next day all pulsation had ceased in the tumor, but the patient died of hemorrhage at the place of the ligature, twelve days after its application.

Finally, benefit may occasionally arise in subclavian aneurism from *manipulation* of the tumor, as practised by Mr. Fergusson; some of the clots detached in the operation may accidentally find their way into the distal extremity of the vessel, and thus occlude its caliber along with the interior of the aneurismal sac. In a disease so desperate as this is known to be, and in which every expedient hitherto devised has been tried in vain, any suggestion that holds out the least possible chance of relief is worthy of trial.

ANEURISM OF THE AXILLARY ARTERY.

Aneurism of the axillary artery is less frequent than that of the subclavian. In 364 preparations of aneurism in the London museums, examined by Mr. Crisp, including 249 of the aorta, the axillary artery was affected only 8 times. In 551 cases, analyzed by him from different sources, including 234 cases of aneurism of the aorta, 18 only were of the axillary artery.

The disease is, out of all proportion, most common in men; it follows upon different occupations, and is most frequently met with between the ages of thirty-five and fifty. In very many of the cases it is of traumatic origin. The volume of the tumor ranges from that of an egg to that of a child's head, the average being that of a goose-egg.

Symptoms.—The symptoms of axillary aneurism are generally so well marked as to render it impossible to mistake their character. When the disease arises spontaneously, or without any assignable cause, it may exist for several months without attracting any particular notice, and the same thing occasionally occurs when it results from external violence, as a blow or strain. Generally, however, the tumor rapidly augments in bulk, and produces such a train of phenomena as to lead at once to its detection. Of these, one of the earliest, and at the same time most unpleasant, is the sense of fatigue or uneasiness in the affected part arising from the pressure on the axillary plexus of nerves. This symptom is usually succeeded in a few weeks, sometimes, indeed, in a few days, by a feeling of pain, which is always in direct ratio to the size of the aneurism, being comparatively slight when it is small, and more or less intense when large. Nor is the pain confined to the site of the disease; in most cases it radiates from it, as from a common centre, in different directions, outwards into the shoulder, downwards along the arm, and upwards into the neck. Pressure, severe coughing, the recumbent posture, and the weight of the limb greatly increase it. Numbness of the shoulder, chest, and arm, is another symptom which generally manifests itself at an early period of the disease, and is never absent when the tumor has acquired considerable magnitude. It is always very distressing to the patient, is greatly aggravated by pressure on the swelling, and commonly extends to the ends of the fingers. Indeed, it is at this point that the sensation in question is often most keenly felt.

The pulsation of the tumor, at first faint and scarcely perceptible, becomes very distinct during the progress of the disease, so that it can be felt not only by the fingers, but seen at a considerable distance; sometimes, indeed, ten or twelve feet from the patient. On applying the ear or stethoscope to the tumor, the blood is found to rush into it with more or less violence, producing a peculiar thrill, or whizzing noise, synchronous with the contraction of the left ventricle of the heart In the early stage of the disease, the swelling is soft and elastic, and may be readily emptied by pressure; by degrees, however, it becomes firm, tense, and, in great measure, if not entirely, incompressible. In some cases, especially in those attended with great enlargement, there is considerable diminution of the temperature of the affected limb, with indistinctness, if not entire absence, of the pulse at the wrist, more or less cough, dyspnœa, and shortness of breathing. Occasionally the pulse is fully as strong as in the other arm, but irregular or intermittent, losing several strokes in a minute.

In addition to these symptoms, there is always, when the swelling is large, so much displacement of the clavicle as to render it difficult, if not impossible, to distinguish the pulsation of the subclavian artery, the vessel being deeply buried behind and below the bone. In some instances the collar-bone has been found to be considerably imbedded in the tumor, or partially removed by absorption. Another symptom, which, from its frequency, especially in the latter stages of the disease, requires mention here, is the swelling of the affected limb. This varies in degree in different cases, often extends from the shoulder to the ends of the fingers, and is usually of an œdematous character, pitting under pressure, and becoming aggravated by the dependent position of the part. When thus affected, the muscles lose their contractile power, and the motions of the extremity are proportionably impaired, or entirely annihilated. Sometimes, again, owing to the great magnitude of the tumor, the patient is unable to approximate the limb to the side of the chest. Finally, there is another phenomenon, which, as it is almost invariably present in the latter stages of axillary aneurism, I am disposed to regard as pathognomonic. I allude to the peculiar attitude of the patient, arising from the constant inclination of the head towards the affected side, and the manner in which he supports the corresponding arm: the object of both being evidently to prevent the tension which would otherwise be caused in the tumor. Under these circumstances, too, the countenance wears an anxious and distressed appearance, and, as the system sympathizes with the local affection, there is more or less derangement of the general health.

When the tumor is unusually bulky, it will necessarily greatly encroach upon the clavicle, forcing it upwards into the neck, and at the same time exerting severe pressure upon the subclavian artery, perhaps so much as to render it difficult, if not impossible, to distinguish the pulse at the wrist.

Diagnosis.—Notwithstanding that the symptoms of this disease are usually well-marked, it has sometimes happened that tumors of this description have been opened by ignorant practitioners under the belief that they were abscesses. For such stupidity no apology can be offered.

Still, cases occasionally present themselves, though very rarely, in which it is extremely difficult, at first sight, to distinguish between this and other swellings in the armpit or subclavicular region. Enlarged lymphatic ganglions, adipose tumors, or encephaloid growths, for example, if they happen to lie along the course of the axillary artery, might have its pulsation imparted to them, and thus create some doubt in regard to their real character. Under such circumstances, the facility with which the tumor can be elevated or removed from the vessel, the absence of the peculiar whizzing sound, previously alluded to, as being generally present in aneurismal disease, the slight pain and numbness in the part and in the corresponding limb, the continuance of the swelling on the application of pressure to the subclavian artery, and, above all, the history of the case, will generally be sufficient to enable the practitioner to arrive at a correct diagnosis.

In this disease the tumor may be situated either immediately below the clavicle, or in the axilla, properly so called. In the former case, it may not only elevate the clavicle, but extend up into the neck, beneath the bone, as far as the acromial margin of the scalene muscles. In the latter, it has been known to reach some distance down the arm, so as to compress the brachial artery and nerves, and prevent the approximation of the limb to the side.

Treatment.—Axillary aneurism occasionally undergoes spontaneous cure, as in the instances reported by S. Cooper and Breschet. Such an occurrence, however, is extremely uncommon. Most generally the disease, if left to itself, terminates fatally, either by rupture of the sac and exhausting hemorrhage, or by gangrene of the limb. In a few rare cases the tumor destroys life by inducing caries of the ribs and perforation of the pleura, followed by a discharge of its contents into the cavity of the chest. In a case narrated by Mr. Guthrie, it was ascertained, on dissection, that the aneurism had forced its way into the right side of the chest by the destruction of a portion of the first five ribs, and had contracted adhesions to the upper lobe of the lung, into which it had gradually opened and discharged its contents, the man having spat blood more or less profusely for several weeks prior to his death. In a similar case mentioned by Dr. Neret, of Nancy, an aneurism, about the size of a large chestnut, was seen to communicate with a cavity as large as the head of a new-born infant in the upper part of the left lung. The man had been admitted into the hospital on account of hemoptysis.

The only remedy for axillary aneurism is ligation of the subclavian artery, and it need hardly be said that the sooner this is done the more likely will it be to effect a cure. The operation, however, should not be declined, even although gangrene of the sac has already commenced, provided there is nothing else to forbid it. I am not aware that aneurism of the axillary artery has ever been cured by compression, nor is this surprising when we reflect upon the difficulty of approaching the subclavian under such circumstances, and also the proximity of the axillary plexus of nerves, which could hardly be induced to brook such an attempt for a sufficient length of time to produce any good effect. If the procedure is ever admissible, it will be in those cases

where the tumor is uncommonly small, and the subclavian more than ordinarily superficial. The vessel might then be reached and successfully compressed either by the finger, the handle of a key, or the instrument delineated at page 631, figure 129. If the parts were very tender, the patient might be kept gently under the influence of chloroform while the necessary pressure is maintained, just as the obstetrician occasionally blunts the sensibility of the female for many hours together in protracted and painful labor.

Mortality.—Of 27 cases of axillary aneurism, which I analyzed in 1841 in the Western Journal of Medicine and Surgery, including one of my own, and for which the subclavian artery was tied, 17 recovered and 10 died, death occurring from the third to the thirtieth day, either from hemorrhage, gangrene of the arm, ulceration of the artery, pericarditis, pleurisy, or pneumonia. In one case it seemed to have been caused by effusion into the brain, and in one, my own, it was consequent upon rupture of the aneurismal sac into the thoracic cavity. In the tables of Dr. Norris, showing the mortality in 69 cases in which the subclavian artery was tied for aneurism, including 9 of wound of the axillary artery and 2 of tumors not aneurismal, though supposed to be so at the time, 36 are stated to have recovered, and 33 to have died.

In three of the cases mentioned in my paper, the subclavian was secured on the tracheal side of the tumor, and all proved fatal. In one of the cases, that of Mr. Colles, the ligature was not tightened till the fourth day after the operation, owing to the supervention of excessive dyspnœa and cardiac oppression.

In my own case, the tumor burst at the end of the twenty-sixth day after the operation, discharging its contents into the right thoracic cavity, and thus causing fatal pleuritis. The patient, a man, aged thirty-six years, was suddenly seized with intense pain in the chest, which was particularly severe at the base of the right lung, from which it extended over towards the sternum, on the one hand, and up towards the axilla, on the other. The respiration was hurried, laborious, and fifty-six in the minute; and the pulse, which was quick and tense, rose rapidly to one hundred and forty. Two days after the accident, the patient experienced a sensation near the upper part of the chest, as if a fluid were passing from the pleuritic cavity into that of the aneurismal sac, and on carefully auscultating the spot, a plashing sound could be distinctly heard at every inspiration, the noise resembling that produced by shaking water in a closed vessel. The respiration in the right lung was now bronchial, and there was extensive dulness on percussion of that side of the chest. It is proper to add that the tumor prior to the operation was about the volume of a large fist, and that the ligature, which had been placed on the artery on the external side of the scalene muscle, came away on the fourteenth day. The dissection revealed the following facts, the arteries having previously been injected.

The wound made in the operation was completely cicatrized, and the pectoral muscles, although somewhat attenuated, retained their natural appearance. The subclavian artery terminated abruptly at

the outer margin of the scalene muscle, where the ligature had been applied, its caliber being closed by a mass of solid fibrin, about one-third of an inch in length, which adhered firmly to the lining membrane, and thus afforded an effectual barrier to the passage of the blood. Between this and the thyroid axis the vessel was occupied by a dark coagulum of blood, which, as it was unadherent, was probably formed only a short time before death. Beyond the seat of the ligature the artery had a rough, ragged appearance, and was sufficiently pervious to admit of the ready passage of a small probe into the aneurismal sac. Superiorly the tumor was overlapped by the brachial plexus of nerves, while in front, at its lower part, was the subclavian vein, which, besides being thrown out of its natural course, was considerably diminished in size. No pus was anywhere discoverable, the parts immediately involved in the operation being intimately consolidated by plastic lymph. The aneurismal tumor, placed immediately below the clavicle, was of a conical form, and about the volume of a moderate-sized orange, being two inches and a quarter in diameter at its base. Its walls varied in thickness at different points from half a line to the eighth of an inch, and its interior communicated by means of an oval aperture, one inch and three-quarters in length by an inch and a half in width, with the pleuritic cavity: it was situated between the first and second ribs, nearly equi-distant between the sternum and spine, and was obviously the result of ulcerative absorption induced by the pressure of the tumor. Both ribs were denuded of their periosteum immediately around the opening, and the serous membrane had a shreddy, ragged aspect. The aneurismal sac contained a few reddish clots arranged in a laminated manner, and closely adherent to its inner surface, especially at the part corresponding with the apex of the tumor.

The right thoracic cavity contained nearly three quarts of bloody-looking serum, intermixed with flakes of lymph and laminated clots, the latter of which were of a reddish-brown color, and had evidently been originally lodged in the aneurismal sac. The pleura exhibited everywhere marks of high inflammation, while the right lung was greatly reduced in volume, from the compression of the effused fluid. The left lung was considerably engorged, and at one or two points almost hepatized. The heart and pericardium were sound. The abdominal viscera presented nothing unusual. None of the arteries appeared to have been affected by disease.

There can be no doubt, from the manner in which this case terminated, which was one of a traumatic character, that the ulcerative absorption which gave rise to the opening above referred to, and which finally led to the escape of a portion of the contents of the aneurismal sac, commenced prior to the deligation of the artery, having been produced by the violent pulsative action of the tumor. Could such an accident have been foreseen, I should not have hesitated to empty the sac to relieve the parts of pressure, objectionable as such a procedure certainly would be in ordinary cases.

An instance of a character similar to the above occurred in 1823, in the practice of Mr. Bullen, of England, and is related in the twentieth

volume of the London Medical Repository. The patient was a man, aged thirty-six years, and the aneurism, which was of nearly five months' standing, also occupied the right side. Eighteen days after the operation, the tumor began to increase in size and to become painful. Very soon evidence of suppuration appeared, and at the end of a week, from six to eight ounces of bloody pus were ejected during a violent paroxysm of coughing, the sac immediately diminishing one-half in volume. A puncture being made into the swelling, five ounces of a similar fluid were discharged, to the great relief of the patient. It was now apparent that there was a cavity between the first and second ribs, near their sternal extremities, through which the matter had found its way into the lung, and which now readily admitted air from the latter organ, whenever the man coughed, at which time a little also escaped at the artificial opening. By degrees, the discharge of matter ceased, the cough grew less and less, and at the end of three months the recovery was perfect.

LIGATION OF THE SUBCLAVIAN ARTERY ON ITS TRACHEAL ASPECT.

This vessel is sometimes ligated on the inner side of the scalene muscles. The subjoined table, comprising ten cases, will serve to place the subject in its true light.

No.	Operator.	Sex.	Age.	Result.	Remarks.
1	Colles	M.	33	Death	In this case there was only a space of three lines between the sac and the bifurcation of the innominate. The patient died of hemorrhage on the fourth day.
2	Mott	F.	21	Death	The patient died on the eighteenth day of hemorrhage.
3	Hayden	F.	57	Death	The patient died on the twelfth day of hemorrhage.
4	O'Reilly	M.	39	Death	The patient died on the thirteenth day of hemorrhage.
5	Partridge	M.	38	Death	The patient died on the fourth day of pericarditis and pleurisy.
6	Liston	M.	—	Death	Patient died of hemorrhage on the thirteenth day.
7	Liston	M.	32	Death	The patient died on the thirty-sixth day of hemorrhage.
8	Auvert	—	—	Death	Fatal hemorrhage on twenty-second day.
9	Auvert	—	—	Death	Fatal hemorrhage on eleventh day,
10	J. K. Rodgers	M.	42	Death	Fatal hemorrhage on the fifteenth day.

The result in all the above cases, except one, has been death by hemorrhage, notwithstanding the undoubted ability and skill of the operators, comprising some of the most illustrious names in surgery. Should this fact not be sufficient to deter practitioners from repeating the operation? or should they continue in their efforts to save life until some one, more fortunate than the rest, shall succeed in finding an exceptional case? The case of the late Dr. J. Kearney Rodgers, of New York, in which the artery was secured on the left side on account of an aneurism, is full of the deepest interest in this respect, as showing that, although the patient finally perished from hemorrhage, yet the ligated vessel was completely closed by an adherent coagulum.

Until the operation of Dr. Rodgers, it was universally regarded as impracticable to ligate the left subclavian artery on the inside of the scalene muscles, such being the intimate relation of the vessel in this

situation to the bag of the pleura, the carotid artery, internal jugular vein, pneumogastric nerve, and thoracic duct. It had been thought that, from the severe injury which would necessarily be inflicted upon the surrounding structures during the operation, violent and fatal inflammation must be the speedy and inevitable consequence. At all events, no one had yet been found ingenious enough to devise, and bold enough to execute, such an enterprise. Although it is not likely that the operation will soon be repeated, yet the case in question deserves brief notice here as a matter of surgical history, if nothing more.

The patient was a man, aged forty-two, who, in consequence of lifting a heavy weight, upwards of a month previously, suddenly became the subject of aneurism of the left subclavian artery. At the time of his admission into the New York Hospital, the tumor could be seen above the clavicle, about the size of a small hen's egg, extending outwards towards the shoulder, and inwards towards the sterno-cleido-mastoid muscle, by the outer border of which it was considerably overlapped. The signs of aneurism were well marked in every particular. The operation was performed on the 14th of October, 1845. Two incisions were made; one, three inches and a half in length, along the inner border of the sterno-cleido-mastoid muscle, terminating at the sternum, and dividing the integuments and platisma-myoid muscle; and the other, two inches and a half in length, extending horizontally over the inner extremity of the clavicle, the two meeting at a right angle near the trachea. Several small veins having been ligated, and the flap thus formed dissected up, the sternal portion with half of the clavicular of the mastoid muscle was divided upon a grooved director, a procedure which fully brought into view the sterno-hyoid and omo-hyoid muscles and the deep-seated jugular vein, all covered by the cervical fascia. A part of the aneurismal sac was also in sight, overlapping a considerable portion of the anterior surface of the scalene muscle, upon which the operator could distinctly feel the phrenic nerve. By digging with the handle of the knife and fingers, the deep cervical fascia was now divided close to the inner edge of the scalene muscle, when, after a little search, the subclavian artery was easily discovered as it passed over the first rib, pressure upon this portion readily arresting the pulsation of the tumor. The next step of the operation consisted in passing the ligature around the vessel without injury to the pleura and thoracic duct, but this proved to be one of extreme difficulty, owing to the great narrowness and depth of the wound, the latter nearly equalling the length of the forefinger. This, however, was at length successfully accomplished by means of an aneurismal needle with a movable point, carried from below upwards. The moment the ligature was tied all pulsation in the tumor ceased, and the patient, if not entirely comfortable, made no complaint of any kind.

The wound became somewhat erysipelatous after the operation, but, on the whole, the patient got on well until the 26th of October, when, on changing his position in bed, hemorrhage supervened, and continuing to recur at various intervals, destroyed him on the fifteenth day.

On dissection, the wound was found to be filled with clotted blood, beneath which the artery had been completely divided by the ligature, which lay loose close by. The stump of the subclavian, between the aorta and the point of ligation, was about an inch and a quarter in length, and thoroughly impervious to air and liquids, its caliber being occupied by a solid and firmly adherent coagulum. The distal extremity of the subclavian contained a soft, imperfect clot, while the vertebral artery, which was given off immediately at the site of the ligature, was almost patulous, and had evidently been the seat of the hemorrhage which caused the patient's death. The aneurismal sac, the size of a small orange, was completely blocked up with coagula. The thoracic duct was uninjured, but the pleura at the bottom of the wound was found to be extensively lacerated, and through the opening thus formed a large quantity of blood had passed into the left cavity of the chest.

In reflecting upon this interesting case, Dr. Rodgers regretted that he had not secured the vertebral artery and also the thyroid axis, believing that this would have effectually prevented the fatal hemorrhage.

ANEURISM OF THE BRACHIAL ARTERY AND ITS BRANCHES.

Spontaneous aneurism of the brachial artery and of its terminal branches, the radial and ulnar, is extremely uncommon, for the reason, adverted to in a previous section, that ossification and fatty degeneration of the coats of these vessels are of such great rarity compared with the same lesions of the femoral and its principal divisions. I have, in fact, never witnessed a single example of the disease, and I am not aware that it has ever been noticed by any one in this country. Several cases, however, are mentioned by foreign authorities, among others by Desault and Scarpa. Spontaneous aneurism of the ulnar and radial arteries are spoken of by several writers, but in so vague a manner as to render it difficult to determine whether the disease depended upon degeneration of the coats of the vessels, or merely upon laceration by external injury.

All these arteries are subject to traumatic aneurism; the brachial, however, is much more frequently involved than the radial and ulnar; and one of the most common causes of the occurrence is venesection at the bend of the arm, the puncture of the lancet establishing a communication between the vein and the artery, thus giving rise to what is called an arterio-venous aneurism. Or, instead of this, the instrument may almost completely sever the artery, and so induce a diffused aneurism, not opening into the vein, but diffusing its contents, up and down, over a large portion of the inner and forepart of the limb. Some of these latter cases are occasionally very formidable, requiring great judgment and skill for their successful management.

Arterio-venous aneurism may sometimes be cured by systematic compression of the brachial artery, at a distance of five or six inches from the seat of the disease; but in general the most expeditious plan is to lay open the sac, turn out its contents, and tie the artery above

and below, the inferior ligature being necessary to prevent hemorrhage from the recurrent branches.

Wound of the brachial artery, without communication with a vein, should be treated, if the case can be reached soon after its occurrence, by compression; but if there be extensive extravasation of blood, constituting what is usually, but improperly, called a diffuse aneurism, the vessel must be exposed at the site of injury, and ligated at its cardiac and distal extremities.

Aneurisms and wounds of the ulnar and radial arteries must be treated upon the same general principles as those of the brachial artery, and do not, therefore, require any special mention. Compression can rarely be rendered available, except at the wrist, and even here it will usually be found to be unsatisfactory, on account of the difficulty of maintaining it in a firm and steady manner. Hence, the proper way is always to ligate the affected vessel at once, not waiting until the parts have become obscured by the extravasated blood. As both arteries are very deep-seated in the upper and middle portions of their extent, rendering it very difficult to expose them, it has been proposed, when they are wounded in these situations, to ligature the brachial; but the objection to this procedure is that, while the cardiac extremity of the affected vessel will thus be closed, the distal one will remain patent, and thus admit of a continuance of the hemorrhage by the recurrent circulation.

Wounds of the arteries of the hand, especially of the palmar arch, are best managed by free incisions and the application of two ligatures. It is great folly, under such circumstances, nay, it is positively worse than folly, to tamper with the comfort and welfare of the patient by the use of compression, either direct or indirect, if the vessel be of any considerable size. Only precious time is wasted; the bleeding will return whenever the mechanical support is taken off, and in this way the patient may lose quarts of blood before the hemorrhage is finally arrested, as I have known to happen in more instances than one. The ligation of the radial and ulnar arteries will be equally unavailing, for blood will still be sent to the wound by the interosseous branch, and even if this also were secured, still the probability is that the bleeding would go on, especially if some time had elapsed since the occurrence of the accident, owing to the communication of the anastomosing vessels. We now and then read of cases in which the brachial artery has been tied for the arrest of hemorrhage of the palmar arch. Can there be anything more absurd than such a procedure, or show a greater degree of ignorance of the anatomy of the hand? The advice of John Bell, in his Principles of Surgery, in regard to the treatment of wounded arteries in general, cannot be too strongly enforced here: "Meet the danger boldly, and don't be afraid to look your enemy in the face."

ANEURISM OF THE COMMON ILIAC ARTERY.

The history of aneurism of this vessel remains to be developed. Nothing short, in fact, of a careful analysis of the various recorded

cases of it can place it in its true light. That the disease is extremely uncommon in its occurrence is a circumstance which has long been familiar to surgeons. The table of Mr. Crisp supplies only 2 cases of aneurism of this artery in 551 cases of the lesion as it shows itself in different portions of the arterial system. Both occurred in males. In one, the tumor was seated on the right side; the patient was a sailor, exposed to hard labor in whale-fishing; the aorta was tied by Dr. Murray, of the Cape of Good Hope, but the man died twenty-three hours after the operation. In the other case, the aneurism, also seated on the right side, was of a fusiform shape, and communicated with the common iliac vein. No operation was performed.

The following table exhibits the results of five cases in which the abdominal aorta has been tied for aneurism of the common iliac.

No.	Operator.	Date.	Sex.	Age.	Result.	Remarks.
1	Cooper	1817	M.	38	Died in 40 hours	The operation was performed for aneurism of the left iliac artery. The tumor being of enormous size, extending four inches above and four inches below Poupart's ligament; the thread was applied three-quarters of an inch above the bifurcation of the aorta. The sac contained an immense quantity of clotted blood.
2	James	1829	M.	44	Died in 3½ hours	There was an external iliac aneurism, for which the femoral was ligated. Increasing in size, 33 days afterwards the aorta was tied. The ligature was applied eleven lines above the bifurcation of the vessel, and five below the mesenteric artery.
3	Murray	1834	M.	33	Died in 23 hours	There was an extensive aneurism of the right external iliac, the tumor reaching as high as the umbilicus, and more than half way across the lower part of the abdomen. Mortification of the limb was rapidly approaching when the operation was performed. The aorta was tied about four lines above its bifurcation.
4	Monteiro	1842	M.	31	Died in 10 days	A large tumor occupied the lower part of the abdomen and upper part of the thigh. It was a spurious aneurism of the femoral artery, caused by the bursting of that vessel. The patient died, at the expiration of ten days, of secondary hemorrhage, from a small opening in the vessel corresponding with the knot of the ligature, which had been applied four lines above the point of bifurcation.
5	South	1856	M.	28	Died in 43 hours	The aneurism occupied the external and common iliac, and was of immense size. The ligature was applied a little above the bifurcation of the aorta.

It will be perceived from the above table that the five cases in which the abdominal aorta has been tied, all terminated fatally; a result which might assuredly have been foreseen by the distinguished surgeons who performed the operation. Questionable as the propriety of such an operation is, I should, I confess, be strongly tempted to perform it if my patient were placed in circumstances precluding all hope of relief from any other source. That this was the feeling which prompted Sir Astley Cooper, in 1817, to undertake it, and which has since induced others to imitate his example, is more than probable, and our only regret is that their efforts have not been crowned with success. What the effect might have been if the cases had been of a more favorable nature prior to surgical interference is, of course, merely a matter of conjecture, but it is perfectly evident, from their

history, that they were all in as desperate a condition as they could well have been at the time. The tumor, in every instance, was of enormous volume, almost, in fact, ready to burst; in Mr. Murray's patient there was, besides, incipient gangrene of the lower extremity. In the case of Mr. James, an error of diagnosis had been committed, which led, improperly, as was afterwards proved, to ligation of the femoral artery, thereby causing the patient not only much suffering but the loss of much valuable time, upwards of four weeks having elapsed between the two operations.

In performing the operation, the peritoneum was divided in two of the cases, and left intact in three; in one instance, it was opened to the extent of nearly four inches. Such a procedure would probably of itself have been a cause of death, had the patient survived the immediate effects of the deligation of the vessel.

The case of Dr. Monteiro, the most successful of all, is replete with interest, as it establishes the fact that the circulation may go on in the lower extremities, after the flow of blood in the abdominal aorta has been completely arrested by the ligature. The patient survived the deligation ten days, when he died of secondary hemorrhage, caused by a small aperture in the side of the vessel corresponding with the knot in the thread. The dissection showed that the peritoneum, which had not been cut in the operation, was perfectly free from inflammation. The aorta had been ligated four lines above its bifurcation, and an inch below the inferior mesenteric artery. The aneurism, which was a false one, had originated in a rupture of the upper extremity of the femoral artery, from which the blood had made its way upwards, underneath Poupart's ligament, through the intermuscular cellular tissue, into the iliac fossa, and thence on behind the peritoneum along the posterior part of the abdomen, as high up as the diaphragm and liver. The common and external iliac arteries were involved in the tumor, and were in an inflamed and friable condition. The external wound had nearly healed.

It is worthy of remark that the pulsation in the tumor ceased immediately on tying the ligature, but returned slightly on the third day, and became more marked on the fourth. Hemorrhage supervened the day before death. The operation was followed by coldness of the lower extremities, but in four hours afterwards this had passed off, and the temperature was now a little above the natural point. No paralysis was present at any time in the limbs.

ANEURISM OF THE INTERNAL ILIAC.

Aneurism of the internal iliac, gluteal, and sciatic arteries is very uncommon, and their history has not been studied with sufficient care to enable us to present anything like a satisfactory account of them. Owing to the deep situation of the former of these vessels, the diagnosis of aneurism occupying its course would necessarily be attended with considerable difficulty, and should not be declared without a good deal of reserve and circumspection. Aneurism of the sciatic and gluteal arteries is more frequently traumatic than spontaneous. In fat, mus-

cular subjects the disease is generally difficult of recognition, and hence it is not surprising that solid growths have sometimes been mistaken for it. Mr. Guthrie once tied the internal iliac artery for a tumor which he had taken to be aneurismal, but which, after death, was found to be of an encephaloid character, the deception having been caused by the circumstance of the tumor having received a distinct impulse from the artery. I have not met with aneurism of the pudic artery, and am not aware that the disease has ever been observed in this country. Mr. Erichsen states that the only instance of the kind with which he is acquainted is exhibited in a preparation in the Museum of the College of Surgeons at London.

Aneurism of the gluteal and sciatic arteries may be treated by ligaturing the internal iliac, or exposing the sac by a free incision, turning out its contents, and tying the vessel above and below. Such a proceeding would, unquestionably, be very bloody, but by far less hazardous in the end than deligation of the internal iliac.

The *gluteal* artery has been tied at least twice in this country for the cure of aneurism; once by Dr. Davidge, of Baltimore, and once by Dr. George McClellan. The tumors being of great bulk, the incisions were obliged to be unusually large, and the loss of blood was very profuse. Notwithstanding this, however, both patients made an excellent recovery.

ANEURISM OF THE EXTERNAL ILIAC.

Aneurism of the external iliac is a rare affection. In the table of Mr. Crisp, the most elaborate hitherto furnished, it occurs only 9 times in 551 cases, while the femoral is mentioned 66 times, and the popliteal 137 times. In 364 specimens of aneurism contained in the London museums, the same writer found the external iliac affected in 7 cases, the femoral in 12, and the popliteal in 50. The nine cases analyzed by Mr. Crisp all occurred in males: two, between twenty and thirty; four, between thirty and forty; one, at forty, and one at fifty-six, the age of the other not being given. The disease is most common in hard working persons. One of the worst cases of it that I have ever seen occurred in a priest.

The tumor in this disease may be seated at any part of the artery, but in general it will be found rather low down, and that, as it progresses, it manifests a tendency to pass underneath Poupart's ligament into the upper part of the thigh. It usually rapidly augments in size, and is capable of attaining a large bulk, encroaching upon the iliac fossa and the pelvic cavity, lifting up the peritoneum, and pressing forward the structures in the inguineo-femoral region, so as to give rise to great deformity in this situation. The pulsation, thrill, and bellows sound are usually very distinct. If the patient be very thin, compression of the abdominal aorta will arrest the movements of the tumor, and diminish its volume, thus serving to distinguish it from other affections. The diagnosis is, nevertheless, not always so easy as might at first appear. Several cases have been reported where the common iliac artery was ligatured on account of morbid growths,

supposed to be aneurismal, which afterwards proved to be of a malignant character. On the other hand, a tumor really aneurismal, has occasionally been confounded with one altogether of a different character. Such a mistake is most likely to happen when the aneurism is partially solidified by the coagulation of its contents, thereby preventing the perception of pulsation. It is only necessary to allude to the possibility of such an occurrence in order to put the practitioner upon his guard in the investigation of his cases.

When an aneurism of the external iliac artery has attained a considerable bulk, the patient walks with extreme difficulty, and is unable to flex the thigh upon the pelvis. The whole limb is enlarged and œdematous from the obstruction to the return of the venous blood, while the pressure of the tumor upon the femoral nerves keeps up constant pain, with a sense of numbness and stiffness, in the parts below, generally extending as far down as the foot and toes.

Aneurism of the external iliac artery, if left to itself, proves fatal in one of three ways, either by rupture and hemorrhage, gangrene of the sac or limb, or constitutional irritation. A spontaneous cure now and then occurs, but the circumstance is extremely rare, and, therefore, does not deserve to be taken into the account in our therapeutic considerations.

The only remedy hitherto employed in the *treatment* of this disease was deligation of the artery leading to the tumor; the external iliac, when the aneurism was situated low down, so as to leave a sufficiency of the superior portion of the vessel intact, and therefore in a suitable condition for the reception of the ligature; or, when the reverse was the case, the common iliac, one of the most formidable operations in surgery. I believe, however, that it will be found that the tumor may generally be promptly obliterated, especially in its earlier stages, by compression of the iliac as it passes over the brim of the pelvis; and, although I am not aware that this practice has ever been adopted, yet I am the more inclined to regard it as feasible, from the fact that the external iliac does not give off any branches, in any portion of its course, so as to offer any barrier to the process of solidification of the contents of the sac. The epigastric and circumflex iliac arise just above Poupart's ligament, and could not, therefore, in any wise interfere with the cure. If a case of aneurism of the external iliac should be presented to me, I should certainly give this mode of treatment a fair trial, and should feel very sanguine of success. Digital compression would of course be preferable to any other, on account of the greater facility of its application.

The result of the ligation of the artery leading to and feeding the tumor, has, on the whole, been rather encouraging. In the nine cases mentioned in Mr. Crisp's table, the common iliac was tied in two, one recovering, and the other perishing of hemorrhage on the eighth day. In four cases the external iliac was ligatured, and all got well. In one instance both the femoral artery and the abdominal aorta were tied, but the man died a few hours after the last operation. One case was cured spontaneously, and another recovered under compression.

ANEURISM OF THE FEMORAL ARTERY.

Aneurism of the femoral artery is very common, although less so than that of the popliteal. In Mr. Crisp's cases, 551 in number, 66 relate to the femoral artery, of which 61 occurred in males, thus showing that the disease is very rare in women. The period of life at which it is most frequently met with is from thirty to fifty. As in the other arteries, aneurism of the femoral is most common in the laboring classes, particularly in those persons who are subject to severe muscular exertion of the lower extremities, causing a sudden strain upon the vessel. Instances have been observed in which each femoral artery was simultaneously affected with aneurism, and it occasionally happens that the same vessel has two such tumors connected with it.

The femoral artery is not equally subject to aneurism in all parts of its extent. The superior third suffers more frequently than the rest of the vessel, and external aneurism occurs here much oftener than in any other artery, except the popliteal. Sailors are said to be particularly liable to the disease in this situation, owing, as Mr. Crisp supposes, to the violent flexion and extension of the thigh which they are obliged to make in mounting the rigging and performing other labors on ship-board. I have never seen an instance of spontaneous aneurism in the lower third of the thigh, and general experience concurs in declaring that such an occurrence is extremely uncommon. In some of the published cases, the disease is described as having been femoro-popliteal, a term evidently intended to convey the idea that the lesion involved both the terminal portion of the femoral and the incipient portion of the popliteal.

Diagnosis.—The diagnosis of femoral aneurism, although generally easy, is sometimes involved in so much obscurity as to cause not a little perplexity. This is more especially the case when the tumor is seated along the middle or lower third of the thigh, where the artery is tightly bound down by the muscles and aponeuroses. Abscesses and various morbid growths, solid, semi-solid, or fluid, and malignant and non-malignant, are the affections with which it is most liable to be confounded; and it behooves the surgeon, in every case of doubt, to institute the most careful and thorough examination before he expresses an opinion in regard to its character, or permits himself to engage in any operative procedures for its relief. The best diagnostic, unquestionably, is the effect which compression of the femoral artery exerts upon the tumor, when it is situated some distance below Poupart's ligament, or of the ileo-femoral, when it occupies the superior part of the thigh. If the tumor be aneurismal, the compression will not only arrest its pulsation, thrill, and bellows sound, but, while it is being kept up, it will enable the surgeon to squeeze out its contents, and thus greatly diminish its volume, circumstances which cannot possibly occur when the swelling is of a non-aneurismal character, whatever may be its structure or consistence. The exploring needle is only to be used in cases not admitting of discrimination by the method here suggested,

and then it should be so fine as not to cause hemorrhage or excite inflammation.

The femoral artery in the upper portion of its extent, is sometimes protruded forward by a *synovial bursa*, situated behind the psoas muscle, just below Poupart's ligament, especially when the pouch is inflamed and much distended, in which case it will probably receive an impulse from the vessel, so as to cause the swelling to simulate aneurism. The proper way to determine the diagnosis is to flex the thigh upon the pelvis, a procedure which, by taking off the tension of the muscle, puts a stop to the pulsation of the tumor, and thus reveals the true nature of the disease.

A number of *lymphatic ganglions* lie in the upper part of the thigh, immediately upon and around the femoral artery. Enlargement of these glands has been mistaken for aneurism, and, conversely, aneurism for enlargement of the glands; but the history of the case and a careful examination of the parts will generally promptly clear up the diagnosis.

Psoas abscess occasionally points below Poupart's ligament, and might be mistaken, by a careless observer, for aneurism of this vessel, or of the external iliac. The best diagnostic signs are the want of pulsation, the soft and fluctuating character of the swelling, the absence of discoloration of the skin, and our ability to efface the swelling almost entirely, when the patient lies on his back with the thigh and pelvis a good deal elevated. Moreover, if there is pus, a drop will be sure to follow the withdrawal of the exploring needle.

Progress.—The course of the aneurism is variable. When it is situated high up, it is liable, in its progress, to extend upwards, and to project at length beneath Poupart's ligament into the pelvic cavity. When, on the other hand, it involves the inferior portion of the artery, it may pass down into the ham, and so simulate popliteal aneurism. The swelling usually increases rather rapidly, and, in time, often spreads over a large space, diffusing itself, in fact, widely, in consequence of the giving way of the two inner tunics of the artery. When this is the case, the limb below the seat of the tumor becomes greatly enlarged and œdematous, from obstruction to the return of the venous blood, and the patient constantly complains in it of stiffness, pain, and numbness, extending generally as low down as the feet and toes. In the more advanced stages of the disease, progression becomes difficult and finally impracticable, the whole limb feeling like a dead, heavy mass. A spontaneous cure occasionally occurs; but most commonly the disease goes on from bad to worse, until life is destroyed by gangrene, excessive suppuration, hemorrhage, or constitutional irritation.

Treatment.—The treatment of aneurism of the femoral artery may, I think, generally be successfully conducted by compression, especially now that our means of applying and regulating it are so much better understood than formerly. The compression may be made either with the finger or by means of one of the numerous mechanical contrivances now before the profession. In the case of a negress, aged thirty-two, who was under the joint care of my son and myself, last summer, on account of a large aneurism of the upper third of the femoral

artery, the assistants succeeded in effecting complete solidification of the contents of the sac in forty-six hours, by digital compression alone. The tumor progressed most favorably, and in less than three weeks after the operation, the woman was able to walk about the house. In this case, referred to in a previous section, there was not more than an inch of space between the aneurismal sac and Poupart's ligament, in consequence of which the compression was obliged to be applied to the iliac artery as it passed over the brim of the pelvis. Several instances of an equally gratifying termination have followed this treatment in the hands of other surgeons.

When compression is inapplicable, the only resource of course is deligation of the artery which supplies the tumor with blood. The operation is easily done at Scarpa's triangle when the aneurism occupies the middle or lower third of the femoral artery, or even when it extends up to the inferior portion of this space, provided the coats of the vessel are sufficiently sound to bear the pressure of the ligature. When this is not the case, or when the tumor is situated high up, near Poupart's ligament, or projects beneath it partly into the pelvic cavity, the proper remedy will be ligation of the external iliac, an operation which, although not devoid of risk, has now been performed so often and so successfully as to be justly ranked among the established resources of surgery.

Mortality.—In Mr. Crisp's 66 cases, above referred to, the external iliac alone was tied in 43, and in two others both this artery and the femoral; 36 of the patients recovering, and 10 dying. Of the latter, three perished from hemorrhage, four from gangrene of the sac or limb, one from tetanus, one from exhaustion, and one without any apparent cause. In 12 of the cases the femoral artery alone was tied, with a result of 9 cures to 3 deaths. Amputation was successfully employed in five cases; in two, the tumor was obliterated by compression, and in one the disease spontaneously disappeared.

In the table of Dr. Norris, comprising 118 cases of ligation of the external iliac artery, of which, however, 97 only relate to aneurism, 85 recovered, and 33 died, three of the former having undergone amputation of the limb in consequence of gangrene. In 4 of the 97 cases of aneurism, the disease existed simultaneously both in the thigh and in the ham, and in three of these the operation succeeded in curing both tumors. A return of pulsation in the sac took place in 9 cases, and hemorrhage in 14, of which seven proved fatal, and seven recovered. In 10 cases the tumor suppurated after the operation, although they all ultimately did well. Gangrene of the limb occurred in 16 cases out of the 118, of which 12 died. In two instances the peritoneum was wounded, but both patients recovered.

Finally, a number of cases of femoral aneurism have been recorded in which a cure was effected simply by refrigerant applications to the tumor, aided by steady compression with the bandage, strict recumbency, and an abstemious regimen. This treatment has occasionally succeeded both in the spontaneous and traumatic form of the disease.

ANEURISM OF THE POPLITEAL ARTERY.

The extraordinary frequency of aneurism of the popliteal artery has long been familiar to pathologists and surgeons. With the exception of the thoracic portion of the aorta, there is no artery in the body which is so often the subject of this disease as this. The table of Mr. Crisp, already so frequently referred to, comprises an analysis of 551 cases of spontaneous aneurism, of which 137 occurred in the vessel under consideration, the thoracic aorta suffering 175 times. Three circumstances seem to serve to establish this extraordinary liability to aneurism on the part of this artery; one is its extreme proneness to ossific and fatty degeneration, another, the curve which it forms behind the knee, and the third, the frequent, sudden, and forcible extension to which it is so constantly exposed in the various movements of the lower extremity.

Age and Sex.—Popliteal aneurism occasionally occurs at a comparatively early age, a number of cases having been observed in which it took place before the twenty-fifth year. Mr. Syme has related one in a child of seven years. The great majority of instances, however, are met with between thirty and fifty. Both sides seem to suffer nearly in an equal degree, and both are occasionally affected simultaneously, or successively, as I have myself witnessed in several individuals. The disease is almost peculiar to men. In Mr. Crisp's cases, 137 in number, 133 occurred in males, and only 4 in females. No occupation is exempt from aneurism of the popliteal artery, but the statistics which have been published upon the subject conclusively show that the laboring classes, especially soldiers, sailors, bargemen, and porters, who are in the constant habit of making long-continued and violent exertions of the muscles of the lower extremities, are more obnoxious to it than any other. The idea, first broached by Morgagni, that postilions and coachmen are particularly prone to popliteal aneurism, has been proved to be erroneous.

Diagnosis.—Aneurism of the popliteal artery is probably produced in most cases by a sudden and violent sprain or twist of this vessel while its coats are in a state of osseous degeneration, and consequently deprived of their elasticity, by which they are prevented from following the various movements of the leg with their accustomed freedom, a sudden rupture being thus induced, of which the patient is himself often made conscious, either by his feeling, or by a kind of snapping noise. The tumor being at first quite small, generally escapes attention until it has acquired a considerable bulk, as, from the great depth at which the artery is situated, and the unyielding nature of the parts in the ham, it takes some time for it to reach the level of the surrounding surface, or to exhibit to the eye the characters of a distinct swelling. A careful examination, however, will always enable us, even at an early period, to arrive at a satisfactory conclusion respecting the nature of the case, except, perhaps, in very fat subjects. The tumor will be found to throb synchronously with the artery in the groin, and by grasping it firmly between the thumb and finger it may readily be

pushed about in the hollow between the tendons of the flexor muscles, feeling like an elastic, circumscribed knob, which is easily diminished by pressure, but immediately regains its former size when the pressure is removed. As the disease progresses, the sac increases in volume, and encroaches more and more upon the popliteal space, pushing aside the soft parts, compressing the popliteal vein and nerve, and interfering seriously with the movements of the limb. The leg is habitually bent at an obtuse angle with the thigh, and all efforts to straighten it prove abortive; it is the seat of constant aching pains, with a sense of numbness or tingling; its temperature is notably diminished, and its subcutaneous cellular tissue, owing to the obstruction to the return of the venous blood, is loaded with serum, or serum and lymph, giving the surface a glossy, shining appearance, and causing it to pit under pressure. The ear and the hand readily detect the characteristic thrill and bellows sound.

Aneurism of the popliteal region is liable to be confounded with other tumors, and we read of cases in which the sac was laid open under the impression that the disease was not arterial. The lesions for which it is most apt to be mistaken are abscesses, solid and fatty growths, and synovial burses.

Abscess of the ham is of very uncommon occurrence, and is in general easily distinguished by the history of the case, its inflammatory character, by the absence of pulsation, by the presence of fluctuation, especially when the matter is considerable in quantity, and by our inability to produce any change in the volume of the swelling by compression of the femoral artery high up in the thigh. When any doubt exists, a small exploring-needle, carefully inserted into the tumor, will readily determine the diagnosis.

Solid growths, of various kinds, benign and malignant, are liable to form in the popliteal region, and might be mistaken for aneurism, especially by a careless and inexperienced surgeon. The fact that such tumors are usually stealthy in their origin, tardy in their development, firm in their consistence, and free from pulsation, will always readily distinguish them from aneurism of the popliteal artery.

A *synovial burse* is occasionally developed in this space, but the occurrence is rare, and it would be difficult to imagine how such a growth as this should ever be confounded with an aneurism in this region. In the Louisville Medical Review, a case of this affection is reported by Dr. S. W. Gross, in which the largest tumor of this description that I have ever seen, occurring in a man, aged twenty-nine years, was readily diagnosticated by the exploring-needle, although its history —especially the absence of pain and pulsation, its non interference with the patient's occupation, and the preservation of the natural appearance of the leg below the knee—had been sufficiently denotive of its true nature without any expedient of this sort.

Progress.—Aneurism of the popliteal artery may remain circumscribed for a considerable length of time; but, in general, it becomes soon diffused, and by its pressure upon the surrounding structures causes not only great pain and swelling in the leg below the knee, but a tendency to mortification by cutting off the nervous and vascular

supplies. Such a termination, in fact, is almost inevitable if the case be permitted to proceed unchecked. Sometimes a spontaneous cure occurs, probably in consequence of the pressure of the tumor upon the artery, thereby arresting the circulation in the sac. Professor Pancoast, some years ago, had a case of popliteal aneurism upon which he had intended to operate the next day; but when he got to his patient's room, he found that all pulsation in the tumor had ceased, and the man gradually completely recovered without any farther trouble.

Treatment.—The treatment of popliteal aneurism was, until recently, usually conducted by deligation of the femoral artery in the superior third of the thigh, according to the method of Hunter, first practised in 1785. Since 1840 numerous cases have been cured by compression, and so gratifying has been the result of this procedure that the old operation is likely, before long, to be almost entirely superseded by it.

Mortality.—The mortality from the operation for popliteal aneurism by the Hunterian method would seem to be variable. In the table of Dr. Norris, comprising a list of 188 cases of aneurism for which the femoral artery was tied, 142 were cured, and 46 died. It is proper, however, to add that the ligation in 33 of the cases was performed for other purposes than aneurism of the popliteal artery. The table of Mr. Crisp furnishes 110 cases, operated upon by the Hunterian method, of which 91 recovered completely, 7 required amputation after the use of the ligature, and 12 died. Of the 11 cases of double popliteal aneurism comprised in it, all were cured; 10 by ligature, and one by compression. The greatest cause of the mortality after the ligation of the femoral artery, is gangrene of the leg.

Traumatic aneurism of the ham is unusual. Cases have occurred where it was occasioned by a sabre wound, a musket ball, or the sharp end of a piece of bone, in fracture of the femur above the condyles. A few cases are also recorded of arterio-venous aneurism in this situation, in consequence of ulceration establishing an interchange of blood between the popliteal artery and vein.

ANEURISM OF THE ARTERIES OF THE LEG AND FOOT.

Spontaneous aneurism of the arteries of the leg is almost unknown. The traumatic form of the disease, however, is occasionally met with, and there are few cases in surgery more difficult to manage, especially when the lesion involves the posterior tibial artery, owing to the great depth at which this vessel is situated, and the confused condition of the parts in consequence of the extravasated blood. The proper remedy, of course, is free exposure of the affected vessel, removal of the coagula, and ligation of both ends. To accomplish this to the best advantage, often involves great coolness on the part of the operator, and an unusual amount of anatomical knowledge and dexterity. During the operation, the iliac artery should be compressed at the brim of the pelvis, or a tourniquet be applied round the upper part of the thigh. Without such precaution, the hemorrhage might be frightfully profuse.

Injuries of the arteries of the foot are often followed by troublesome

hemorrhage, which may eventually become quite exhausting. Cases of this kind are, more than almost any other in surgery, a stumbling-block to men ignorant of surgical anatomy, and it is not going too far to say that they are also, at times, exceedingly perplexing to the educated practitioner, annoying, fretting, and worrying him until his patience is nearly exhausted. The arrangement of the arteries in the sole of the foot is very similar to that of the palm of the hand; the anastomosis between the plantar arteries is very extensive, and hence when these vessels are wounded it often becomes extremely difficult to arrest the flow of blood permanently without the use of the knife and ligature. It might be supposed, at first sight, that well-regulated, systematic compression would put an effectual stop, in most cases, to the hemorrhage, but this, it is well known, is not the fact. It arrests the bleeding temporarily, and that is all. If an occasional exception occurs, it is an exception merely, nothing more. The rule is that the plantar arteries, when divided, will continue to bleed until they are secured by ligature. Why, then, not ligate them at once, without waiting until the patient is blanched and exhausted by the loss of blood, in the vain hope that compression may eventually stop it? That this is the proper course of procedure, is unquestionable; the only objection to it is the extensive wound which we may be obliged to make in order to bring the bleeding vessel fully into view, so as to enable us to apply the ligature. Still, as this must generally be done, sooner or later, in every case, we cannot too strongly insist upon its being done as early as possible after the infliction of the injury. In making the necessary incisions, care must, of course, be taken not to disturb any important structures; and in every instance the golden rule must be observed to tie each end of the bleeding vessel, lest the hemorrhage should continue through the recurrent branches.

It has been proposed in these cases to cut down upon and tie the principal arteries of the leg, and we read of instances in which even the great trunk of the thigh was ligatured for such a purpose. Such a procedure cannot be too strongly condemned, as being contrary both to common sense, anatomical knowledge, and sound experience. The experiment of tying both the tibial arteries has been tried again and again under such circumstances, and the almost invariable effect has been complete failure; as might, indeed, have been anticipated from a careful study of the disposition of the arteries of the foot.

Notwithstanding the somewhat pointed manner in which I have here spoken against compression in hemorrhage of the plantar arteries, it is but proper to add that I have seen this very method occasionally put a most prompt and effectual stop to the flow of blood. I recollect distinctly the case of a little girl, which came under my observation many years ago, where I succeeded, by a single dressing, in arresting an exhausting and daily recurring hemorrhage of upwards of a month's duration. A graduated compress placed over the orifice of the bleeding vessel, and confined by a roller extending from the toes upwards, aided by elevation of the leg and cold applications, constituted, as it always should when such a procedure is adopted, the means employed on the occasion.

Sometimes we may advantageously resort to the expedient of compressing the anterior and posterior tibial arteries by means of two corks, placed directly over the vessels, opposite the malleoli, and bound down firmly by a suitable bandage, passed around the foot and leg in the form of a figure 8. The corks should each be wrapped up in a bit of patent lint, and should be at least three-quarters of an inch in length, and of proportionate thickness and breadth, otherwise it will be difficult to make them retain their proper position. When the compression is obliged to be made with great firmness, it may be well, in order to defend the soft parts, to extend a piece of sheet-lead across the limb under the bandage.

SECT. VIII.—OPERATIONS ON THE ARTERIES.

LIGATION OF THE INNOMINATE, OR BRACHIO-CEPHALIC.

Although the innominate may easily be exposed on the dead subject, as was shown by Dr. George McClellan as early as 1820, by a linear incision carried vertically down in front of the trachea, without dividing any of the cervical muscles, yet I believe that such a plan would be ill suited to the purpose when there is a large tumor pressing upon and displacing the parts which environ this vessel. The operator must have ample room, and it will not, I presume, materially affect the issue of the case whether a little more or a little less tissue is cut. The plan suggested by Dr. Mott, in his celebrated case, is, on the whole, it seems to me, the one best adapted for obtaining ready access to this artery, and is that which I should myself follow if I were called upon to secure the innominate for the cure of aneurism. The incision resembles, in outline, the shape of the letter L, the horizontal limb corresponding with the upper border of the clavicle and sternum, and the vertical with the inner margin of the sterno-cleido-mastoid muscle, each being about three inches in length. The lower incision extends as far inwards as the centre of the trachea. The triangular flap thus mapped off, embracing the skin and platisma-myoid, being dissected up, the sterno-cleido-mastoid, sterno-hyoid, and sterno-thyroid muscles are respectively separated upon a director from their inferior connections and turned out of the way. A layer of the deep cervical fascia is now cautiously pinched up and divided, when, by a little scratching with the finger-nail, the handle of the scalpel, or the end of a probe, the carotid will be brought into view a few lines above the top of the sternum, accompanied by the jugular vein and pneumogastric nerve. Taking this vessel as his guide, the surgeon can easily trace the course of the innominate downwards towards the heart, and isolate it from its associate vein. The ligature, when the case admits of it, should be applied about the middle of the vessel, the needle being carried around it from left to right and from behind forwards.

In performing this operation, it should be remembered that this artery is only about sixteen lines in length; that it rests upon the

trachea, which it crosses somewhat obliquely at the base of the neck; that the middle thyroid veins, and sometimes the middle thyroid artery, run along its inner side; and that on the right side, and on a plane anterior to it, is the innominate vein, the two malleoli being intimately united together by cellular substance, and in close relation behind with the pneumogastric and phrenic nerves, the latter lying external to the former. The top of the pleura is a little inferior and external to the artery, and might, unless great caution is used, be easily wounded. The middle thyroid artery is sometimes given off by the innominate on its tracheal aspect, and should be looked for in isolating the vessel, as its division might be followed by annoying hemorrhage.

LIGATION OF THE COMMON CAROTID.

To Mr. Abernethy is usually, but erroneously, ascribed the merit of having first tied the common carotid. From some remarks of Hebenstreit, it appears pretty certain that the operation had been performed some time previously by a surgeon during the extirpation of a scirrhous tumor of the neck, in which he accidentally divided this vessel, and immediately surrounded it with a ligature, the patient soon recovering. The English surgeon did not ligature the artery until 1798; the case was one of wound of the internal carotid, and the man died in thirty hours. The first operation that was performed upon it for carotid aneurism was by Sir Astley Cooper, in 1805, and was unsuccessful, the case terminating fatally on the nineteenth day. Three years subsequently, he ligated the vessel again, and now with a happy result.

There are two points of the neck at which the common carotid may be tied, the place of election being regulated by the circumstances of the particular case. These are the upper and inferior cervical regions, and it will be well, in every instance before the operation is begun, to recall to mind the more important anatomical relations of the parts, otherwise serious blunders may arise, such, for example, as tying the omo-hyoid muscle or jugular vein instead of the artery, or including along with the artery the vessel just named, or some important nerve, as the pneumogastric, sympathetic, or laryngeal. As the artery proceeds upwards, it is overlapped by the sterno-mastoid, sterno-hyoid, and sterno-thyroid muscles, and crossed by the omo-hyoid towards its superior extremity. Running down in front of its sheath is the descending branch of the ninth pair of nerves, a little, thread-like filament, easily recognized by its whitish appearance, while within the sheath are, on the external side of the artery, the internal jugular vein, and behind and between them the pneumogastric nerve, the sympathetic and recurrent nerves being posterior to the sheath. These relations are very intimate, and hence the most cautious procedure is necessary in isolating the parts previously to the application of the ligature. The embarrassment is often immensely increased by the manner in which the artery is overlapped by the jugular vein, which occasionally, though less frequently than is generally supposed, swells out enormously during every effort at expiration, so as to obscure the vessel and render its liga-

tion extremely difficult. The best way of remedying this is to request an assistant to compress the vein both at the upper and lower angle of the wound, the blood having been previously pressed out of it.

The common carotid, on the right side, is sometimes absent, its place being supplied by two trunks, which, arising separately from the arch of the aorta, ascend along the neck, assuming the office of the external and internal carotid. When this arrangement exists, which, however, is extremely rare, the order of origin of the branches of the aorta is as follows: the right subclavian, right external carotid, right internal carotid, left common carotid, and left subclavian. It should also be borne in mind that the common carotid may, on the one hand, bifurcate very low down, not perhaps reaching as high up as the inferior border of the thyroid cartilage, and, on the other hand, it may not separate into its terminal divisions until it gets to the angle of the jaw. Lastly, it may be crossed in front by the inferior thyroid artery, lie upon the vertebral artery as this vessel passes along the spine, and include in its sheath the descending branch of the ninth pair of nerves.

In ligating the carotid, the patient should be recumbent, with the head inclined to the opposite side, and well supported by pillows, the shoulders being at the same time somewhat raised, in order to place the neck in a proper horizontal position. If he do not desire to take chloroform, he may sit on a chair, the head resting against the breast of an assistant.

In the lower part of the neck the artery may be exposed by making an incision, from two and a half to three inches in length, along the inner border of the sterno-cleido-mastoid muscle, commencing just above the clavicle. The skin and platysma-myoid muscle being divided, a portion of the cervical fascia is pinched up with the forceps, and opened transversely to an extent large enough to admit a grooved director, upon which the membrane is then slit up and down nearly to the length of the outer incision. Two retractors are now inserted into the wound, one being used to draw the sterno-cleido-mastoid muscle outwards, and the other to draw the sterno-thyroid inwards towards the trachea. The sheath of the artery being thus exposed, a little piece of it is now raised with the forceps, and divided horizontally, when, the director being introduced, it is slit open so as to denude the artery to a small extent, and enable the operator to isolate it from the jugular vein and the pneumogastric nerve, the ligature being passed from without inwards. Generally a small subcutaneous vein will be found passing along the line of incision, communicating above with the facial vein, and below with the thyroid plexus. This must, of course, be carefully avoided.

The artery being more easy of access in the superior part of the neck than the inferior, this point should always be selected, when this is in our power, for ligating it. To expose the vessel in this situation, an incision should be carried along the inner margin of the sterno-cleido-mastoid muscle, commencing a little below the cricoid cartilage, and reaching nearly as high up as the angle of the jaw. Embracing the integuments, platysma-myoid muscle, and cervical fascia, it will thus conduct the operator at once down to the sheath of the vessel,

which is then to be opened in the same cautious manner as in the previous case; and the artery being separated gently from the accompanying structures is ligated by passing the needle round it from without inwards, so as effectually to exclude the jugular vein. The omo-hyoid muscle which crosses this part of the carotid must be held aside with a hook.

Fig. 208.



The annexed cut (fig. 208), represents the common carotid as being exposed by a long incision, with a view of showing where it is crossed by the omo-hyoid muscle.

The carotid is sometimes tied at a very early age. I recollect a case in which I assisted Dr. McClellan, where that excellent and brilliant operator secured this vessel in a child only five months old, on account of an immense nevus of the upper part of the face. I remember, also, that the descending branch of the ninth pair of nerves was divided on the occasion, as it interfered with the passage of the ligature. No untoward symptoms of any kind occurred; the tumor diminished somewhat after the operation, but in less than a month it was larger than ever.

Ligation of the common carotid is occasionally required on account of wounds of the neck involving the external carotid or some of its branches. The operation is often embarrassing in consequence of the confused condition of the parts from the extravasation of blood, and is, moreover, not always successful, owing to the establishment of a return current through the internal carotid into the external carotid. Hence secondary hemorrhage, sometimes of a very profuse character, is liable to ensue, necessitating further proceeding, and that, perhaps, at a time when the wound is in a high state of inflammation. In order to avoid all this, Dr. Gurdon Buck has proposed the simultaneous ligation of the common and internal carotid arteries, and in the New York Medical Times for November, 1855, he has given the particulars of a case in which the operation was followed by the most gratifying results.

The common carotid artery has been repeatedly secured for wounds, epilepsy, and erectile and other tumors, as well as for the purpose of restraining hemorrhage in operations upon and about the jaw, face, and neck. The statistics of these operations present points of much interest, and they have been placed in a very clear light by the tables of Dr. Norris. In 30 cases in which the artery was tied on account

of wounds, 15 recovered, and 15 died; in 16 cases in which it was ligated previously to, or at the time of the extirpation of tumors of the jaw, face, or neck, 8 died; in 6 in which it was tied for the cure of epilepsy, all recovered from the effects of the deligation, although in 2 both vessels were secured; and in 42 cases in which it was tied for the cure of erectile tumors and various growths of the diploë, orbit, neck, jaw, and maxillary sinus, 20 were cured, 13 died, and 9 recovered from the effects of the operation without being materially benefited. In upwards of 20 of the 94 cases, more or less severe cerebral symptoms followed the operation.

Dr. James R. Wood, in 1857, published the details of 39 cases in which the primitive carotid was secured by different surgeons of the city of New York for various affections, as secondary hemorrhage, malignant growths, benign tumors, epilepsy, and aneurism of the branches of the carotid, with a loss of only six. Of these six cases, only five were dissected. The cause of death in two was found to be softening of the brain, in one inflammation of the jugular vein, in one pericarditis with abscess in the lung and liver, and in one exhaustion.

A number of cases have been reported in which both these vessels have been tied, either simultaneously or after a variable interval. The following table affords a summary view of nearly all the examples of this kind that have yet occurred.

Operator.	Date.	Age.	Sex.	Disease.	Interval.	Result.	Remarks.
Macgill	1823	Adult	F.	Tumors of both orbits		Improved	Vision destroyed before operation, and eyes presenting a mass of disease.
Mussey	1827		M.	Anastomotic aneurism of scalp	12 days	Failed	Pulsation returned in tumor, which was excised three weeks after second operation.
Mussey		28		Ditto	28 days	Recovered	
Müller	1831	4½		Erectile tumor	4½ mo.	Recovered	
Preston	1831	51	M.	Epilepsy	84 days	Failed	Fits had existed for six years, and had latterly been attended with palsy on one side.
Preston				Epilepsy	1 mo.	Failed	Convulsions the day after each operation. No material relief.
Kuhl	1834	53	M.	Aneurism of the occiput	72 days		The second operation was performed during a profuse hemorrhage of the scalp. The first operation was followed by syncope and convulsions.
Mott				Disease of parotid	15 min.	Died in 48 hrs.	
Mott				Malignant polypi	Several months	Recovered?	
Ellis	1844			Secondary hemorrhage	4½ days	Recovered	
J. M. Warren	1845	23		Erectile tumor	33 days	Failed	Tumor occupied the mouth, face, and neck. Subsequent excision of the diseased structures, followed by cure.
Hamilton		18		Epilepsy	6 mo.	Recovered	
Robert			F.	Aneurism	8 mo.	Recovered	
Blackman			M.	Disease of antrum	21 days	Recovered	
W. Parker	1854	42	M.	Malignant disease of nose & orbit	32 days	Died	

Of the above cases, 15 in number, 13 recovered from the effects of the operation, and 2 died. In Dr. Mott's case, where both vessels were tied almost simultaneously, coma soon supervened, and the man died in forty-eight hours. In the case of Dr. Ellis, of Michigan, the second deligation was performed at an interval of four days and a half, on account of secondary hemorrhage consequent upon a gunshot wound, and no unpleasant symptoms followed, the patient making an excellent recovery. In Dr. Mussey's case twelve days intervened between the two operations, neither of which was succeeded by any accident. To Dr. Macgill, of Maryland belongs the credit of being the first to tie both carotid arteries on the same subject.

LIGATION OF THE EXTERNAL CAROTID AND ITS BRANCHES.

The external carotid, extending from the superior border of the thyroid cartilage to the neck of the lower jaw, is situated, just above its origin, in the triangular space formed by the omo-hyoid muscle below, the digastric above, and the sterno-mastoid externally, immediately beneath the integuments and platysma-myoid; but it soon sinks deeper in, passing up under cover of the stylo-hyoid and digastric muscles, and is finally buried in the substance of the parotid gland. It is accompanied by two veins, and is crossed near its commencement by the hypoglossal nerve, and, in various parts of its course, by branches of the external jugular and other veins. The glosso-pharyngeal nerve is interposed between this artery and the internal carotid, while the superior laryngeal nerve lies under both.

Deligation of the external carotid is seldom required for anything else than wounds and vascular growths about the face and head. The vessel is often opened in attempts at suicide, though less frequently than is generally imagined; for persons intent upon self-destruction usually bend the neck so far back as to place the artery beyond the reach of the knife. Some of its branches are, however, commonly injured under such circumstances, especially the superior thyroid and lingual, and the hemorrhage thus produced may be promptly fatal. A ligature may be readily placed round the external carotid, in the first part of its course, by carrying an incision, about two inches and a half in length, along the inner edge of the sterno-mastoid muscle, commencing opposite the middle of the thyroid cartilage, and terminating at the angle of the jaw. The trunk of the common carotid will guide the finger to its external division. The incision should be made with great care, lest violence be done to some of the numerous offsets of the vessel. The artery, as it lies beneath the digastric and stylo-hyoid, is exposed with difficulty; the incision must be proportionably large, and the muscles just mentioned must be well depressed with the retractor.

The principal branches of this artery requiring surgical consideration, are the superior thyroid, lingual, facial, occipital, and temporal.

The superior *thyroid artery* is, as already stated, much exposed to injury in attempts at suicide, and may, under such circumstances, be easily traced simply by following the wound. If it becomes necessary

to ligate it, as is sometimes the case in hypertrophy of the thyroid gland, with a view to diminish the supply of blood, it may be laid bare by making an incision across the upper part of the neck, obliquely downwards and outwards from the side of the hyoid bone to the edge of the sterno-mastoid muscle.

The *lingual artery* may be exposed in the same manner as the thyroid, near which it takes its origin; its situation, however, is very deep, and its relations are so complicated that it is generally better to secure the external or common carotid.

The *facial artery* is frequently concerned in operations about the neck, face, and lips, and may be easily compressed with the finger as it passes over the jaw. If divided, it should immediately be secured. When its ligation becomes necessary, in case there is no wound, its pulsation will point out the proper situation for the incision. When it is desired to secure it just above its origin, the incision should be made as in the operation upon the lingual, its approach being facilitated by drawing the digastric strongly upwards.

The *occipital artery* sometimes requires ligaturing on account of wounds, but its depth in the lower part of its extent is such as to protect it generally from injury involving the cervical region. On the back of the head, however, it is not unfrequently laid open, and usually bleeds very freely. It may be exposed just above its origin by carrying an incision along the inner border of the sterno-mastoid muscle, in the angle formed by it and the digastric, the latter of which must be well drawn down. It is in intimate relation here with the hypoglossal nerve, which hooks round it as it passes forwards towards its destination. The artery, after emerging from the splenius muscle, on the back of the head, is superficial, its course beneath the scalp being denoted by its pulsation.

The *temporal artery* is occasionally wounded, and may be secured immediately above the zygoma, by a short vertical incision, embracing the temporal aponeurosis, immediately beneath which it is situated. Lower down, the depth at which it lies is too great to justify an attempt at ligation. Should it be divided in this portion of its extent, the best plan is to tie the external carotid.

The anterior branch of this vessel is the one always selected in arteriotomy, when it is wished to practise depletion on account of affections of the brain or the brain and its membranes. After a sufficient amount of blood has escaped, the artery is cut across, and a graduated compress applied. If this precaution be neglected, a false aneurism will form.

The *internal maxillary artery* is sometimes wounded, in consequence of a thrust with a sharp knife or dirk. The necessary result, of course, is a copious hemorrhage, for the arrest of which the only remedy is ligation of the external carotid; compression, it is true, now and then succeeds, but the only reliable means is the ligature. When the vessel is wounded in the extirpation of the jaw, it may sometimes be seized and tied; when this is impracticable, the bleeding may generally be stopped with the hot iron, or with the tampon, wet with a saturated solution of alum and tannin, or covered with persulphate of iron.

LIGATION OF THE VERTEBRAL ARTERY.

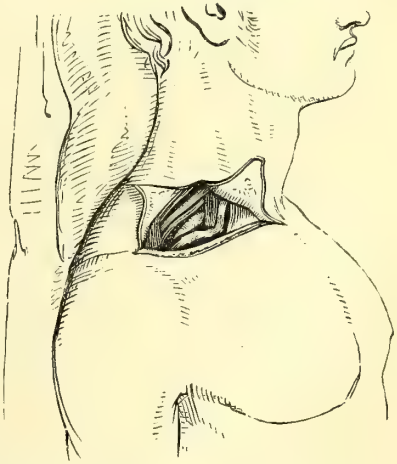
The vertebral artery is the largest branch of the subclavian, and, of course, bleeds profusely when divided, as it occasionally is in wounds of the neck. Taking the opening as his guide, the vessel should be traced to the seat of injury, and a ligature applied to each extremity. The dissection necessary for its exposure should be conducted with the greatest caution, on account of the important and complex relations which the vertebral sustains to the surrounding parts.

LIGATION OF THE SUBCLAVIAN ARTERY.

The point which is usually selected for tying the subclavian artery is just external to the scalene muscle, in what is considered as the third course of the vessel. One single incision will generally be found to be sufficient for the free exposure of the artery, and this may be strictly horizontal or more or less curvilinear, according to the fancy of the operator. It is only when the tumor is so bulky as to cause great malposition of the shoulder, forcing the collar-bone high up into the neck, that two incisions can really be required, the one extending along the upper border of the clavicle and the other vertically upwards, parallel with the outer edge of the sterno-cleido-mastoid muscle.

Previously to commencing the operation, the patient should be placed in the horizontal position upon a narrow table, with his head and chest moderately elevated, and the face slightly inclined towards the sound side. An assistant taking hold of the hand, keeps the affected limb close to the trunk, at the same time that he pulls down the shoulder as much as possible, in order to draw the clavicle away, as it were, from the subclavian artery as it passes from the scalene muscle towards the first rib. The surgeon, standing by the side of the patient, above the shoulder, stretches the integuments of the neck upon the upper part of the chest with the fingers of the left hand, while with the other he makes an incision, about two inches and a half in length, directly along the middle of the clavicle, commencing at the sternal origin of the mastoid muscle and terminating near the anterior margin of the trapezius. In this manner he divides the skin, the superficial fascia, and the platysma-

Fig. 209.



Plan of the relative position of the subclavian artery, in its outer third.

myoid. Letting go his hold with his left hand, the parts will be found instantly to resume their natural situation, leaving thus the incision on a level with the superior border of the clavicle. The next step of the operation consists in detaching from this bone the deep cervical fascia, or rather aponeurosis, which may readily be accomplished by a few gentle strokes of the handle of the scalpel instead of the point of the instrument, which would greatly endanger the surrounding vessels and nerves. The external jugular vein will be found close to the outer edge of the mastoid muscle, and should be held out of the way with a blunt hook. The supra-scapular artery will also generally appear, at this stage of the proceeding, just above and behind the clavicle, or partially covered by it, and should be treated in a similar manner; or, if it be divided, it should immediately be tied. The omo-hyoid lies at the outside of the incision, bound down by a process of the cervical aponeurosis, which should next be torn through with the knife. Taking the anterior scalene muscle for his guide, the operator feels for the tubercle of the first rib, a little to the outside of which the artery will be found pulsating, more or less distinctly, and where it may in general be easily secured by passing the needle from before backwards and from below upwards. Before tightening the ligature, it should be ascertained that it controls the circulation of the aneurismal sac, and, above all, that it does not include any of the cords of the axillary plexus of nerves, a circumstance which has happened in several of the cases in which this operation has been performed. It should be stated that whenever the clavicular origin of the mastoid muscle is unusually broad, as it not unfrequently is, it should be divided upon a grooved director. By pursuing this course, I am convinced that our approach to the vessel will, in the majority of cases, be greatly facilitated. Particularly will this be the case when the design is to apply the ligature behind the scalene muscle.

In this manner, the subclavian may, in the generality of cases, be easily reached without much waste of blood or loss of time. In some instances, however, the operation is rendered extremely difficult, tedious, and embarrassing, owing either to the magnitude of the tumor and the consequent elevation of the clavicle, the diseased state of the artery, an unusual course of the vessels of the neck, or, even when these follow their natural direction, the swollen and distended condition of the subclavian vein, some irregularity on the part of the omo-hyoid, an enlarged condition of the cervical lymphatic ganglions, or, finally, the great condensation of the parts from the effusion of plastic lymph. A few remarks on each of these topics must suffice.

1. The *elevation of the clavicle* is generally in direct proportion to the size of the tumor. Sometimes, however, even when the swelling is comparatively diminutive, this bone is situated much higher up than usual, owing to the peculiar conformation of the individual. In either case, the difficulty of finding the vessel will be much increased. In one instance, where the elevation was produced by the enormous development of the disease, Sir Astley Cooper was forced to abandon the operation altogether. When such a contingency arises, which, on the whole, must be extremely rare, instead of giving up the case in despair,

as was done by the English surgeon, the best plan, it seems to me, would be to divide the anterior scalene muscle, so as to enable us to apply the ligature somewhat nearer the heart, or even on the tracheal side of that muscle.

2. The operation is occasionally rendered more or less intricate and embarrassing by the *diseased state of the artery.* In this case, although the vessel may be easily enough approached, it is impossible to apply the ligature at the usual situation. To divide the scalene muscle, or to cut down along its inner margin, for the purpose of securing the vessel at one or other of these points, is here our only resource. The brachial plexus of nerves may also be so much in the way of the operator as to render this course necessary, as happened on one occasion to Dupuytren.

3. The *cervical vessels*, both arterial and venous, are almost constantly in the way of the operator, even when they follow their usual route. This is particularly true of the external jugular vein and of the supra-scapular artery. The former of these vessels, commencing at the angle of the jaw, passes vertically down the neck under cover of the platysma-myoid. In the early stage of its course, it rests upon the sterno-mastoid; afterwards it gets to the outer border of this muscle, and finally, at the inferior part of the neck, sinks behind it, to terminate in the subclavian vein near its junction with the internal jugular. Just before it disembogues, which it sometimes does by several distinct trunks, it receives two pretty large branches, the supra-scapular and transverse cervical, which traverse the neck in a horizontal direction from without inwards, parallel with the arteries of that name. These arteries, as well as their accompanying veins, lie deeply at the root of the neck, especially the supra-scapular, which is frequently concealed for some distance by the clavicle, on a line with which it runs to reach the root of the coracoid process; it is generally a branch of the thyroid axis, and rests at first upon the anterior scalene muscle, crossing as it passes outwards the subclavian artery. The course of the transverse cervical artery is nearly similar, but it is usually situated somewhat higher up; it is also considerably smaller, and is most frequently derived immediately from the subclavian.

Now, in attempting to reach the subclavian, it is almost impossible to avoid wounding some of the vessels above mentioned. The external jugular vein is particularly in danger, and can scarcely escape without the utmost coolness and dexterity on the part of the operator. As soon as it is recognized it should be separated from the surrounding structures by a few gentle strokes with the handle of the scalpel, and drawn to the outer side of the wound. This plan is undoubtedly always the best and safest when it can be adopted; however, it sometimes happens that the vessel is so much in our way as not only greatly to embarrass our progress, but absolutely put a stop to it. In this case, it must be cut across, or, what is preferable, tied with two fine ligatures, and divided between them. By pursuing this method, we not only avoid a troublesome hemorrhage, but effectually prevent the introduction of air into the lower portion of the vessel, an occurrence which should always be guarded against. The supra-scapular

artery, if in the way, should be carefully drawn aside, or, if it be wounded, immediately secured. Any bleeding vessels, indeed, no matter whether arterial or venous, provided they pour out a sufficient amount of blood to interfere with the operation, should at once be tied, though no more ligatures should be retained than are absolutely necessary.

4. The inordinate *swelling of the subclavian vein* is another source of embarrassment which is occasionally experienced in operations of this kind. This vessel is usually situated somewhat below and superficially to the artery, being separated from it by the anterior scalene muscle, upon which it lies. Commencing at the inferior margin of the first rib, where it is continuous with the axillary, it passes horizontally inwards until it joins the internal jugular vein, within a few lines of the sterno-clavicular articulation. In this course, in which it is almost entirely concealed by the clavicle, it receives the small branches which accompany the different offsets of the artery as well as the external jugular, which last enters it, as before stated, nearly opposite the centre of the bone, but sometimes more internally. After the division of the cervical aponeurosis in the lower part of the neck, the operator will occasionally observe this vessel alternately to swell and subside, owing not so much, as some have supposed, to the natural flow of the current within it as to the reflux caused by the action of the right auricle, aided by the hurried and agitated state of the respiratory movements. The difficulty thus occasioned is not only annoying, but sometimes so embarrassing as to render it almost impossible even to see the artery, much less to separate and tie it. To remedy this, it has been suggested that the operation should be suspended for a moment, and the patient placed in the semi-erect posture to allow him to make several full and easy inspirations, after which, it is said, the tension of the vein will be diminished, and the regurgitation of the blood cease. The surest and most expeditious plan, however, is to hold the vessel out of the way by means of a broad blunt hook, or copper spatula, carried down behind the clavicle. In this manner the vein may be effectually compressed to the extent of half an inch, or more, if necessary, and the artery fairly brought into view.

5. The *omo-hyoid* muscle, instead of forming a triangular space, as it usually does, with the scalene muscle and the clavicle, may run parallel with, and just above, that bone, or even entirely below it. In either case, should it be productive of inconvenience to the operator, he should pass a director under and divide it. Such a proceeding, however, can seldom be called for, as, by laying open its sheath, the muscle may generally be drawn out of our reach.

6. The *lymphatic ganglions*, at the inferior part of the neck, may be so much enlarged as to interfere seriously with the different stages of the operation. When this is found to be the case, instead of trying to save these bodies, they should be carefully dissected out, as we shall thus not only expedite our arrival at the artery, but, what is a matter of no little importance, greatly facilitate the healing of the parts after the vessel is tied.

7. Finally, considerable embarrassment may arise from the *condensed*

and indurated state of the parts, caused by the effusion of plastic lymph. This may always be looked for when the disease is of long standing, or when the tumor is so large as to excite severe inflammation in the deep-seated structures immediately above the clavicle, thereby obscuring the nerves and vessels.

If, from the above causes, it be sometimes difficult to denude the artery, to convey a ligature around it will often be found to be much more so. Indeed, this generally constitutes the most annoying and embarrassing step of the operation. To facilitate this procedure, various mechanical contrivances have been resorted to, some of them so complicated in their character as to be well calculated to enhance instead of diminishing the difficulty. Under ordinary circumstances, every indication may be fulfilled with the common aneurismal-needle, or even with a common eyed-probe. Whatever mechanical contrivance be employed, the ligature, as a general rule, should be passed from before backwards and from below upwards, as it will be found much easier in this way to prevent injury to the subclavian vein, while there will be no danger whatever of including any of the cords of the brachial plexus of nerves. Owing to the great depth of the wound, not a little difficulty is sometimes experienced in tightening the knot. In this case the ingenious instrument invented by Dr. Hosack, of New York, will be found very useful. By holding the first knot firm it enables the surgeon to tie a second or third with the utmost facility.

Notwithstanding the assistance to be derived from the different instruments that have been invented for that purpose, such has been the difficulty, in some instances, of conveying the ligature around the artery as to lead not only to great delay, but almost to an abandonment of the operation. It has been suggested, under these circumstances, to saw through the clavicle, and to this proposal I can see no objection, provided the shoulder is so much elevated as to offer an almost insurmountable barrier to the passage of the ligature. By this practice, although a compound fracture of the clavicle would be superadded, yet this would be of the most simple kind, while the operation, instead of occupying from one to two hours, as has repeatedly happened heretofore, could be completed in a comparatively short time; the vessel could be much more effectually secured, the risk of wounding the subclavian vein and other parts would be greatly diminished, and the patient would have a much better chance for recovery.

The arteries which are more particularly concerned in maintaining the collateral circulation after the ligation of this vessel, are the suprascapular, transverse cervical, internal mammary, long thoracic, circumflex, and subscapular, the first three being branches of the subclavian, the other three of the axillary. The thoracic artery frequently arises from the aneurismal sac, and is therefore liable to be obliterated for some distance in the progress of the disease.

The subclavian artery has been tied several times in the second course of its extent, but the procedure is very difficult, as well as replete with danger, owing to the proximity of numerous important structures, especially the phrenic nerve, jugular vein, pleura, and thy-

roid axis. The external incisions are similar to those employed for exposing the artery in the other parts of its extent; as soon as the anterior scalene muscle is fully brought into view, a grooved director is carried behind it, and its lower attachment carefully severed from the clavicle, the phrenic nerve having previously been placed beyond the reach of the knife. The top of the pleura, lying close by, must not be wounded in passing the needle. It will thus be perceived that the operation is one of excessive delicacy, requiring consummate anatomical knowledge and skill for its successful execution. The greatest objection, however, to its performance is that the subclavian is obliged to be tied so close to the superior intercostal and deep cervical branches; a circumstance which must necessarily materially interfere with, if not wholly prevent, the formation of a firm and adherent clot.

The subclavian is occasionally tied for wounds of the axillary artery. In the table of Dr. Norris, comprising 69 cases of operations upon this vessel, 9 were performed for this purpose, and of these, 6 proved fatal. Mr. Guthrie, in his Treatise on the Diseases and Injuries of the Arteries, refers to 22 cases in which the subclavian was ligated for a similar object, 11 times above the clavicle, and 11 times below. Of the former cases, 9 recovered, and 2 died; death in one being caused by the bursting of an internal aneurism, and in the other, by gangrene after amputation at the shoulder-joint. Of the 11 cases in which the artery was tied below the clavicle, 6 recovered, and 5 perished, three from gangrene of the limb, one from exhaustion, and one from hemorrhage.

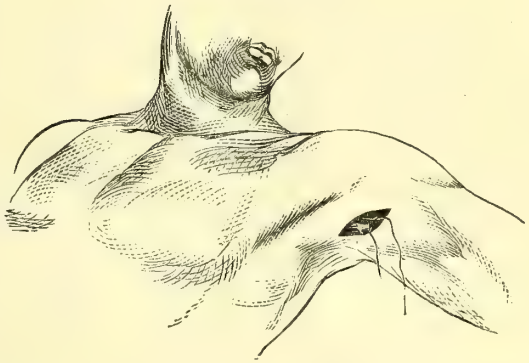
LIGATION OF THE AXILLARY.

The axillary artery requires ligation chiefly on account of penetrating wounds, or its accidental laceration during the reduction of ancient dislocations. Of the latter occurrence, quite a number of cases have been reported by surgical writers. There are two regions where the vessel may be secured, either just below the clavicle, or in the hollow of the axilla. In the intermediate point, the vessel is so deeply situated, and in such intricate relations, as to render its approach a task of much difficulty.

The artery in the first of these regions is very deep seated, and hence it has been advised, instead of tying it, to ligate the subclavian in the third stage of its course. Cases, however, occur, in which it is desirable to secure it soon after its origin, and this can generally be done without any difficulty, provided the surgeon is sufficiently cool and deliberate, and has a thorough knowledge of the anatomy of the parts. The patient being placed in a half-sitting posture, with the arm slightly abducted, an incision is carried along the inferior border of the clavicle, through the skin and platysma-myoid, commencing one inch from the sternum, and extending to within a short distance of the deltoid muscle, care being taken to avoid the cephalic vein, as it lies in the groove between the latter and the great pectoral. The next step consists in dividing the fibres of the great pectoral to the full extent of the external wound. The small pectoral is now seen at the lower portion of the wound, and should be relaxed by bringing the

arm close to the trunk. A retractor being inserted, and the divided structures well depressed, the artery will be found at a short distance below the clavicle invested by a dense fascia, which must be carefully scraped through before the vessel can be fairly exposed to view. The accompanying vein, which often swells suddenly out during expiration, lies below and in front of it, while the brachial plexus is behind, except one of its branches, which is above and in contact with it. The anterior thoracic artery, one of the offsets of the axillary, is also on its anterior surface. The needle is passed from within outwards, in order to exclude the vein. As difficulty is sometimes experienced in distinguishing the artery from the cords of the axillary plexus of nerves, it will be well, before tightening the thread, to ascertain what effect its application has upon the pulse at the wrist, or in the aneurismal sac. The costo-coracoid ligament sometimes requires division in this operation.

Fig. 210.



To expose the artery in its inferior section (fig. 210), the arm should be abducted and supinated, and an incision, nearly three inches in length, made through the axilla, close to the border of the broad dorsal muscle. The cellular and aponeurotic structures being next divided, the median nerve and axillary vein will be brought into view, the two roots of the former embracing the artery on each side, and the latter running along its anterior surface. Cautiously separating these parts with the finger, or the forceps and director, and turning them in opposite directions, the artery is exposed, and tied by passing the ligature from within outwards.

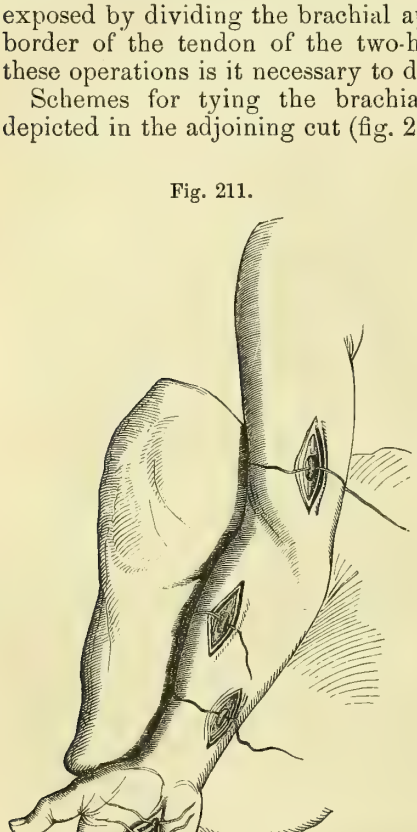
LIGATION OF THE BRACHIAL.

The brachial artery, in consequence of wounds and various kinds of traumatic aneurisms, requires to be ligated more frequently than any other artery in the body. Extending from the lower border of the axilla, on a level with the tendon of the teres muscle, to nearly one inch below the bend of the elbow, it is overlapped above by the coracobrachial muscle, and in the middle by the two-headed flexor, while inferiorly it is completely covered by a reflexion of the brachial aponeurosis. Its whole course, however, is comparatively superficial, so that it is easy to feel its pulsations in the greater portion of its extent. In attempting to secure the artery high up, near its origin, an incision, two inches and a half in length, should be made along the inner

margin of the coraco-brachial muscle, the arm being extended and supinated. The artery, accompanied by its two veins, will be found lying here between the median and ulnar nerves, the former being on its outer side, and the latter on the inner. If the artery be sought for at the middle of the arm, the best guide to its seat will be the internal edge of the two-headed flexor muscle. The median nerve, in this part of the course of the artery, usually lies on the inside and in front of the vessel. At the bend of the arm, the brachial is readily exposed by dividing the brachial aponeurosis in a line with the ulnar border of the tendon of the two-headed flexor muscle. In none of these operations is it necessary to divide any muscular fibres.

Schemes for tying the brachial, radial, and ulnar arteries, are depicted in the adjoining cut (fig. 211).

Fig. 211.



Deligation of the brachial, radial, and ulnar arteries; also of the palmar vessels.

In operating upon the brachial artery, it should be borne in mind that this vessel is subject to certain varieties, which may serve both to perplex the surgeon, and mar the result of the undertaking. The most frequent of these anomalies is the high division of the artery into the radial and ulnar, which, on reaching the elbow, either pursue their usual course, or, as is more generally the case, the former proceeds superficially down the forearm, while the latter becomes deep-seated; or their course may be reversed, the radial following its ordinary route, while the ulnar descends immediately under the skin. Several instances have been met with in which the brachial divided high up into two branches, which subsequently united again into a single trunk, which afterwards bifurcated regularly into the radial and ulnar.

LIGATION OF THE RADIAL AND ULNAR.

The radial artery, whose course along the forearm is indicated by a line drawn from the middle of the bend of the elbow to the forepart of the styloid process of the radius, may be tied near its origin, at its middle, and at its inferior extremity. When the design is to ligate it above, or in the first of these situations, it may be approached by

an incision, about three inches in length, parallel to the inner border of the long supinator muscle, between which and the round pronator the vessel will be found, accompanied by its two veins, the radial branch of the musculo-spiral nerve lying at its outer side and some distance from it. Care is taken not to wound the basilic vein. In the middle third of the forearm, the artery lies between the long supinator and flexor muscle of the carpus, the spiral nerve descending close along its radial border. In the inferior portion of its extent, the artery is comparatively superficial; its pulsation is very distinct in the greater part of its length, and therefore serves as a ready guide to its course.

The ulnar artery is sometimes divided in the upper part of its extent by a knife or ball, and in this event it may generally be easily found by taking the wound as our guide, enlarging it, if necessary, and tying the vessel at each extremity. When a false aneurism exists in this situation, it is usually recommended to ligature the brachial, but I am satisfied that it would be more safe, in every instance, to tie the ulnar soon after its origin by cutting boldly through the thick muscular mass at the upper third of the forearm, as we could thus effectually guard against hemorrhage from the recurrent circulation. In the middle of the limb the artery lies along the radial border of the ulnar flexor of the carpus, which should therefore be taken as a guide to the knife, and be carefully separated from the common flexor of the fingers. The ulnar nerve here lies on the inner side of the vessel. Near the wrist the artery is generally found with facility, its situation being indicated by its pulsation.

LIGATION OF THE ABDOMINAL AORTA.

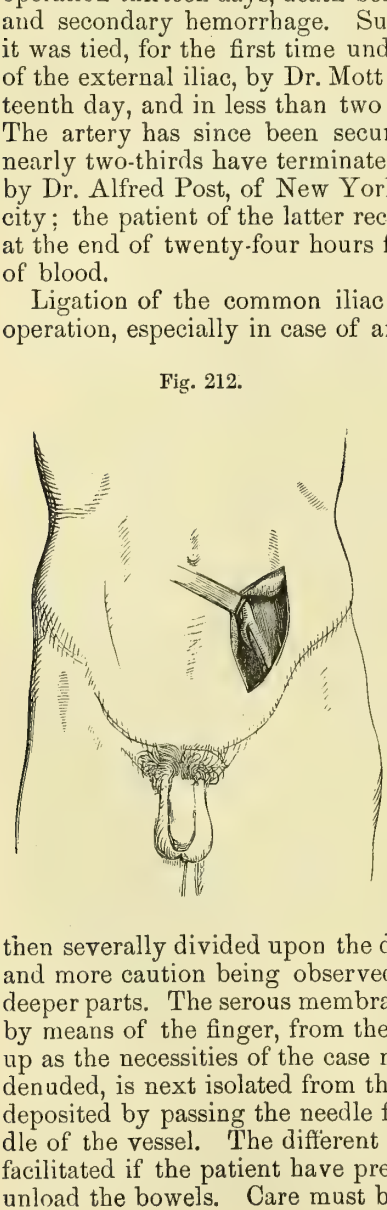
Ligation of the abdominal aorta may be required on account of a wound, either of itself or of the common iliac, and in that event the best plan would probably be to enlarge the external opening to an extent sufficient to encircle the vessel with the thread. In ligaturing the vessel for aneurism, the patient should lie on his right side, and care should be taken to avoid injury to the peritoneum, which can be easily done by adopting the procedure of Dr. Murray, since followed by Monteiro and South, of making a curvilinear incision, with the convexity towards the vertebræ, from an inch above the anterior superior spinous process of the ilium to the cartilage of the tenth rib. It should be fully six inches in length, and should extend, in the first instance, merely through the common integuments. The various underlying structures should then be severally divided until the peritoneum is brought into view, which is cautiously peeled off from the iliac and psoas muscles with the hand a short distance beyond the contemplated point of ligation. The separation of the aorta from its accompanying vein on the right side, and the filaments of the sympathetic nerve in front, constitutes one of the greatest difficulties of the operation, but is generally best effected with a long director, slightly sharp at the extremity, and the nail of the index finger. The ligature should be passed round the artery from left to right, and from behind forwards, about one inch above its bifurcation into the common iliacs.

LIGATION OF THE COMMON ILIAC.

The common iliac artery was first ligated by Dr. William Gibson, of this city, in 1812, in a case of gunshot wound, his patient surviving the operation thirteen days, death being caused by peritoneal inflammation and secondary hemorrhage. Subsequently to this, namely, in 1827, it was tied, for the first time under such circumstances, for aneurism of the external iliac, by Dr. Mott; the ligature came away on the nineteenth day, and in less than two months the man was entirely well. The artery has since been secured in about twenty cases, of which nearly two-thirds have terminated successfully. It was tied in 1840 by Dr. Alfred Post, of New York, and in 1842, by Dr. Peace, of this city; the patient of the latter recovering, but that of the former dying at the end of twenty-four hours from exhaustion induced by the loss of blood.

Ligation of the common iliac (fig. 212) is far from being an easy operation, especially in case of aneurism, attended with a large tumor and morbid adhesions of the peritoneum. The patient lying on his back, with the thighs somewhat relaxed, a slightly curvilinear incision is made along the lower part of the abdomen, about half an inch above Poupart's ligament, commencing at the external ring and passing upwards and outwards a short distance beyond the anterior superior spinous process of the ilium, its length varying from five to seven inches, according to the exigencies of the particular case. The operator should, in every instance, give himself an abundance of room. The first cut extends merely through the skin and superficial fascia. The other structures, beginning with the aponeurosis of the external oblique muscle, are then severally divided upon the director down to the peritoneum, more and more caution being observed in proportion as we approach the deeper parts. The serous membrane is now gently and slowly detached, by means of the finger, from the aneurism and other textures as high up as the necessities of the case may demand. The artery being thus denuded, is next isolated from the accompanying vein, and the thread deposited by passing the needle from within outwards, above the middle of the vessel. The different steps of the operation will be greatly facilitated if the patient have previously taken an active cathartic, to unload the bowels. Care must be taken not to wound the spermatic cord.

Fig. 212.



The primitive iliac arteries extend from the cartilage between the fourth and fifth vertebræ to the sacro-iliac symphysis, diverging from each other as they descend at a somewhat acute angle, their point of commencement being nearly opposite the umbilicus. Each rests on the spine and psoas muscle, and is crossed anteriorly, at its bifurcation, by the ureter. On the right side, the accompanying vein lies, above, behind and external to it, while, lower down, a portion of the vein appears on the inner side; on the left side, the vein passes along the inner side of the artery, both vessels lying under cover of the sigmoid flexure of the colon. Neither artery presents any anomalies of importance in a surgical point of view.

LIGATION OF THE INTERNAL ILIAC.

The ligature of the internal iliac has now been practised in seven cases, the operation having been first performed by Dr. Stevens, of Santa Cruz, in 1812, upon a negress, on account of a spontaneous aneurism of the gluteal artery, nearly of the volume of a child's head. Of these cases four recovered, and three died, a result which may well create surprise when we take into consideration the great depth at which this vessel is situated, the injury that must necessarily be inflicted upon the surrounding parts in exposing it, and the exceedingly unfavorable character of most of the cases themselves prior to the operation. The artery, moreover, is very short and disproportionably large, being generally less than two inches in length; it is, besides, in intimate relation with various important structures, thus rendering it extremely difficult of access. Thus, it lies on the internal iliac vein, which, however, on the right side projects from underneath it over its outer edge; it is crossed above by the ureter, and is overhung by the bladder, while that on the left side lies immediately behind the rectum. Close by are the sacro-lumbar and obturator nerves, the latter, along with the external iliac vein, running in the angle which separates the internal from the external iliac artery.

The manner of exposing the artery is the same as in ligating the common iliac. Dr. White, of Hudson, who tied this vessel successfully in 1827, for gluteal aneurism, made a semi-circular incision on the side of the abdomen, with its convexity to the ilium, seven inches in length, commencing two inches to the left of the umbilicus, and terminating close to the external ring. It is not necessary, however, I conceive, to carry the incision so far inwards, as the object can be just as well attained by the other process, and with less risk of bad consequences. The peritoneum is carefully raised with the fingers; and it is worthy of notice that the membrane, as it is being peeled off, invariably carries with it the ureter, thus placing this duct completely beyond the reach of the ligature. The fascia investing the artery is scraped away with the nail or handle of the scalpel, and, taking the precaution of avoiding the external iliac vein, which lies in the angle between the internal and external iliac arteries, the ligature is deposited by passing the needle from within outwards.

When the internal iliac artery is very short, or the pelvis unusually

small, so as to render the ligation of the vessel very difficult, it would be more prudent to secure the common trunk; the procedure would be attended with less violence to the parts, and with less risk of peritonitis and secondary hemorrhage.

LIGATION OF THE GLUTEAL.

The gluteal artery has been repeatedly ligated on account of hemorrhage and traumatic aneurism, as, for example, in the famous case of Mr. John Bell, where, to use his own hyperbolical language, the incision was upwards of a foot and a half in length. In exposing the vessel for the relief of hemorrhage, the surgeon is necessarily obliged to take the external wound as his guide, enlarging it, if possible, in the direction of the muscular fibres, and giving himself an abundance of room, especially if the artery be divided just as it emerges from the sacro-sciatic notch. It must be remembered that the vessel is accompanied by a vein and nerve, which must be carefully excluded from the ligature. If the artery be cut off close, it may be necessary to pass the thread with a curved needle, and to include in the noose some of the surrounding tissues, as it will probably be impracticable to raise it with the tenaculum.

In case of traumatic aneurism of this artery, most writers recommend the ligation of the internal iliac; but, when we remember the difficulties and dangers of this operation, and the probable occurrence of peritoneal inflammation and of secondary hemorrhage, it seems to me that it would be better, in every respect, to cut down upon and tie the gluteal itself. The operation will of course be bloody and formidable, but skill, boldness, and promptness may accomplish much, even in a case like this, especially when everything is well ordered beforehand, and the assistants are properly instructed in their respective duties. The incision, made in the direction of a line extending from the posterior superior spinous process of the ilium to a point midway between the tuberosity of the ischium and the great trochanter, must be at least eight inches in length, and should be carried at one stroke down into the aneurismal sac, the contents of which should then be turned out, and the artery instantly secured, as it lies towards the upper part of the wound.

LIGATION OF THE SCIATIC ARTERY.

The sciatic artery is also liable to be injured, either by sharp-pointed bodies penetrating the gluteal region, or by falls upon the buttock in which the vessel is laid open by a splinter of bone round which it passes as it proceeds forwards. It is situated under the great gluteal muscle, at first posterior and then internal to the great sciatic nerve, and winds round the spinous process of the ischium, near its root, behind the muscles which are inserted into the intertrochanteric line of the femur. It may be exposed by making a similar incision, as in the preceding case, but about an inch and a quarter lower down. When the operator is in doubt as to which artery is implicated, whether

the sciatic or gluteal, the incision should be made as nearly as possible in the intermediate space.

LIGATION OF THE EXTERNAL ILIAC.

Ligation of the external iliac artery was first practised by Mr. Abernethy, in 1796, in a case of aneurism of the femoral artery, which he had previously tied at the distal side of the tumor; but severe hemorrhage coming on some time after, he found it necessary to apply a ligature above the swelling. The operation, however, failed; and it was not until 1806, after two other attempts, that his efforts were finally crowned with success. In this country it was first performed by Dr. Dorsey, of this city, in 1811, in a case of inguinal aneurism.

There are several methods in vogue for exposing this artery and encircling it with a ligature, each of which has its advantages and disadvantages, although the results have perhaps not essentially varied in any. That of Abernethy, slightly modified, is perhaps the most unexceptionable. It consists in making a curvilinear incision, with the convexity downwards, along the inferior portion of the abdomen, commencing about an inch and a half above Poupart's ligament, just outside of the external ring, and terminating on a level with the anterior superior spine of the ilium, about two inches on the inner side of this process. Its length should be from three inches and a half to four inches, according to the size of the tumor, and the stature of the patient. The first cut, extending through the skin and superficial fascia, will probably divide a few little arteries that should be tied before proceeding any farther. The aponeurosis of the external oblique muscle is now in sight, and should be divided upon the director; then the muscle itself; and afterwards each, in regular succession, of the overlying structures, until the transverse fascia is exposed. This membrane will readily be recognized by its opaque, whitish appearance; and a small hole being scratched through it with the nail or scalpel, is next slit open to the full extent of the outer wound. The next step, and one of the most delicate of all, consists in gently and cautiously detaching the peritoneum from its connections in the iliac fossa; an operation which is often attended with considerable difficulty on account of the morbid adhesions. The iliac artery will now be felt pulsating at the bottom of the wound, having the anterior crural nerve at its outer side, and on a somewhat deeper plane, and the iliac vein at first behind, but afterwards, near Poupart's ligament, internal to it. The sheath covering the artery being now scratched through in front over a sound portion of the vessel, the instrument bearing the ligature is gradually insinuated around it from its inner side, this procedure being found best to avoid injury to the vein.

There are several circumstances worthy of attention in connection with the ligation of the external iliac. In the first place, the ligature should, if possible, be placed round the vessel about its middle, which will be nearly two inches above Poupart's ligament, the artery being usually from three inches and a half to four inches in length. If the ligature be applied low down, near to the origin of the epigastric artery,

there may not be sufficient room for the formation of a coagulum, and the patient may perish of secondary hemorrhage, as happened in one case to Beclard.

Secondly, care must be taken not to wound the peritoneum. I have witnessed several instances in which it was separated with immense difficulty, in consequence of the great firmness with which it adhered to the aneurismal sac, from the effects of plastic deposits. In a case which occurred in the practice of Dr. Post, of New York, the membrane was so much thickened and altered by disease that he found it quite impossible to detach it, but was obliged to make an opening into it in order to admit his ligature.

Thirdly, no little difficulty is occasionally experienced in separating the artery from its accompanying vein, owing to their naturally firm union, which is no doubt often increased by disease. The object is most easily attained with the nail or a probe, slightly sharpened at the extremity.

Fourthly, should the external iliac be found to be too much diseased, or the tumor so large as to overlap the greater portion of the artery, as it may do when the sac extends upwards beneath Poupart's ligament, it will be easy to ligate the common trunk simply by enlarging the wound, especially at its upper angle.

Fifthly, the operation will be greatly facilitated if the patient's bladder and bowels be well evacuated a short time previously.

Lastly, the wound made in the operation should in this, as in the ligation of the other pelvic arteries, be sewed up carefully from the bottom, by carrying the needle close down to the peritoneum; in other words, the muscular and integumental lips should be tacked together separately, the object being the production of firm union, so that there may be no risk of hernia when the patient begins to sit up and walk about.

After the ligation of the external iliac, the collateral circulation is maintained chiefly by the anastomosing branches of the gluteal, sciatic, obturator, and pudic arteries, with the circumflex and deep branches of the femoral.

LIGATION OF THE EPIGASTRIC AND CIRCUMFLEX ARTERIES.

The epigastric artery is occasionally wounded, either accidentally or in operating for hernia, tapping the abdomen, or ligating the iliac. The vessel, although small, may give rise to fatal hemorrhage, the more readily as the bleeding is generally insidious and deep-seated, and it should, therefore, be secured without delay. To do this, an incision, about two inches in length, is made just above, and parallel to, Poupart's ligament, in a line corresponding with its centre, cautiously dividing the parts until the artery is reached, as it lies between the transverse fascia and peritoneum. It is accompanied by two veins, which must be carefully excluded from the ligature. The artery arises on the inner side of the external iliac, about three lines above Poupart's ligament, and ascends inwards just within the inner border of the internal ring, where the deferent duct hooks round it on its way

to the abdominal canal. Should the vessel be cut off close to the external iliac, it might become necessary to cast the thread around this artery instead of the epigastric.

The *circumflex iliac* artery, given off by the external iliac, usually a little lower than the epigastric, is sometimes wounded, and may, from its large size, cause embarrassing, if not fatal, hemorrhage. It may be secured, in the first part of its course, in the same manner, very nearly, as the epigastric, the incision being made close to, and parallel with, Poupart's ligament, its centre being opposite the internal ring. Further out, it may be exposed by dividing the tendon of the external oblique muscle within half an inch of the margin of the ilium, where it is firmly bound down by the transverse fascia.

LIGATION OF THE FEMORAL.

The common femoral artery begins on a level with Poupart's ligament, and terminates from an inch and a half to two inches below in the superficial and deep femoral, the former being its direct continuation. The vessel, in all this course, is perfectly superficial, being covered merely by the skin, superficial fascia, and aponeurosis; it is involved, however, in a number of lymphatic ganglions, which, when they become enlarged, may receive the pulsation of the artery, and so simulate aneurism. The femoral vein lies on the inside of the vessel, in the same sheath, and great care is required in separating it previously to passing the ligature. The femoral nerve lies external to the artery, and is therefore not endangered in the operation. Exposure of the artery is easily effected by a vertical incision two inches in length; the needle should be conveyed from within outwards.

Ligation of the superficial femoral artery is often necessary on account of wounds involving its continuity, and, until a comparatively recent period, it was also frequently practised for the cure of popliteal aneurism. If the artery be severed by a cut, or pierced by a sharp-pointed body, it is evident that it should be secured at the site of injury, the wound being, if necessary, enlarged, and a ligature applied to each extremity of the vessel.

In case of aneurism, the femoral artery may be tied at two points of its extent, namely, at the superior and middle, the former being, however, by far the more eligible, as the vessel here is comparatively superficial, and therefore easy of access. Its course along the thigh is indicated by a line extending from a quarter of an inch within the centre of Poupart's ligament to the inner margin of the patella. In the upper third of the limb, it lies immediately beneath the common integuments and the femoral aponeurosis, its pulsation being easily felt as it runs along the inner margin of the sartorius muscle. This space is from four to five inches in length, and is of a triangular shape, its base being formed by Poupart's ligament above, and its apex by the convergence of the sartorius and adductor muscles below. The femoral vein runs along the inner border of the artery, and is inclosed in the same sheath; the connection between them is very firm and intimate,

and it therefore requires great caution to effect their separation. The femoral nerve lies on the outside of the artery.

To expose the artery in this part of its course, an incision should be made along the inner border of the sartorius muscle, beginning about two inches and a half below Poupart's ligament, and extending obliquely downwards to the lower extremity of the triangle through the skin and superficial fascia. A portion of the aponeurosis is now pinched up with the forceps, and a horizontal opening made in it just large enough to admit the point of the probe, upon which the sheath of the vessel is then carefully divided for the space of about nine lines. The artery is now separated from the vein in the usual manner, but with extreme caution, and the ligature passed from within outwards, close to the former vessel. Injury to the vein would be a serious calamity, as the patient might perish from phlebitis. The occurrence is usually denoted by a gush of black blood upon drawing out the thread. Pressure will readily arrest the flow, and the vessel must on no account be tied. A little nerve occasionally runs down in front of the artery; should this be the case, it must be drawn out of the way.

The femoral artery, in its middle course (fig. 213), is deep-seated, lying under cover of the sartorius muscle, which must, consequently, be turned to one side in the act of exposing it. The corresponding vein will be found external to the artery. In some instances it is double, and then the artery runs between the two vessels, closely hugged by them. In operating upon the superior portion of this space, just below the triangle above described, the incision should be made along the inner edge of the sartorius, which is then everted so as to afford free access to the vessel as it lies beneath the aponeurosis. If, on the other hand, the lower site be selected, the cut should be made on the outside of the muscle; but no one will be likely to do this if he can avoid it, as the operation will be both tedious and difficult, and possesses no advantages whatever over the more common procedure.

Fig. 213.



The femoral artery is subject to certain anomalies which should not be forgotten when we undertake its ligation, as they might seriously affect the result. The most important of these anomalies are the following: First, the high division of the artery, the vessel separating a short distance below Poupart's ligament into two branches, which go

to form the posterior tibial and peroneal. Secondly, the artery may be double, the supernumerary one giving off the branches usually furnished by the profunda. Thirdly, it consists of two equal trunks which afterwards unite to form the popliteal. Sir Charles Bell found this curious anomaly in a negro upon whom he operated for popliteal aneurism, the two vessels coalescing as they entered the ham. In this case the blood in the sac had in a great measure coagulated, notwithstanding that the circulation through it had been maintained by the artery, which had not been excluded from the ligature. A similar instance occurred to Sir Astley Cooper. An abscess formed in the sac, after the detachment of the ligature, and the patient died of hemorrhage. The dissection showed that a large branch had been given off by the femoral artery above the point of ligation, and had again united with that vessel just before it terminated in the popliteal, thereby feeding the tumor, and preventing its obliteration. A case of the entire absence of the superficial femoral artery has been recorded by Manec, its place having been supplied by the sciatic which passed down along the back of the limb to become the popliteal.

Compression of the femoral artery is often necessary on account of hemorrhage, either of this vessel itself, or of some of its branches. It is also frequently employed for the purpose of controlling the circulation of the limb in amputations of the thigh and leg; and latterly, it has been much resorted to for the cure of popliteal aneurism, having, in many cases, superseded the use of the ligature. When the object is to arrest the flow of blood, or stanch hemorrhage, the most suitable point for its application is the margin of the pubic bone, which is separated from the artery only by the pectineal muscle, and upon which, consequently, the pressure may be made with great efficiency. The best instrument for the purpose is the thumb of a stout assistant, or the handle of a large key, resting upon a small, thick pad. The more concentrated the pressure is, the more efficacious it will be in stopping the bleeding, and in preventing injury to the accompanying vein and nerves, circumstances that must not be overlooked in such a procedure. If the force be applied with the thumb, it may often be maintained for several successive days without detriment to the parts.

The other situations at which the artery may be compressed are the upper part of the thigh, just below Poupart's ligament, and those portions of the limb where the vessel may be pressed against the shaft of the femur, by directing the instrument outwards and backwards. When the compression is designed to be permanent, as in the treatment of popliteal aneurism, it should be frequently varied, making it now at this point, and then at that, as it may be painful or otherwise; and it is, moreover, of great importance, under these circumstances, that the instrument with which it is applied should not completely encircle the extremity, lest it impede the return of the blood in the veins, and thus occasion swelling and other mischief.

LIGATION OF THE DEEP FEMORAL.

The deep femoral artery has been known to be the seat of spontaneous aneurism, but the occurrence is extremely rare, and very difficult of diagnosis. The profound situation of the tumor, underneath the muscles at the anterior and inner part of the thigh, will usually serve to throw some light upon its character; but the only reliable sign is the continuance of pulsation, thrill, and bellows sound, with somewhat of an augmented intensity, in the swelling, when firm pressure is made upon the superficial femoral, about two inches below Pouparts's ligament, so as to direct the blood with increased force into the deep vessel. The proper remedy, in such a case, as well as in traumatic aneurism, would be ligation either of the affected artery, or of the common femoral, an inch below its origin, where it is felt beating immediately beneath the skin and aponeurosis. The application of the ligature to this vessel is sometimes required on account of hemorrhage.

The deep femoral is usually given off by the common femoral, from an inch and a half to two inches below Poupart's ligament; but it is sometimes detached considerably higher up, and occasionally it is furnished by the external iliac or by the femoral, immediately after the commencement of this vessel. The artery, soon after its origin, passes inwards, behind the superficial trunk, and gradually places itself under cover of the long adductor muscle, between which and the great adductor it afterwards descends towards the femur, near which it pierces the latter muscle, and finally disappears on the posterior part of the thigh. When this vessel is injured, the wound will, of course, serve as our readiest guide to it; and in that event, two ligatures will always be necessary to put an effectual stop to the hemorrhage. In case of aneurism, the artery may easily be exposed, near its origin, by an incision similar to that which is made in ligating the common femoral, or the superficial femoral, in the superior portion of its extent, beginning an inch below Poupart's ligament, and descending obliquely in the direction of the inner border of the sartorius muscle. The deep trunk may then be readily traced to the requisite extent, and should be encircled a few lines below the origin of its two circumflex branches.

LIGATION OF THE POPLITEAL.

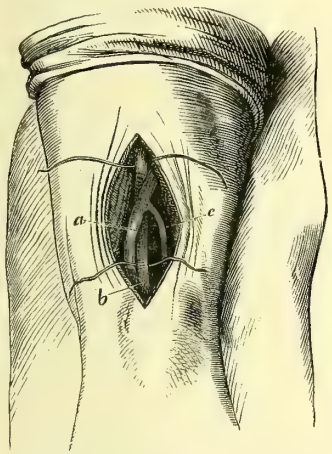
The popliteal artery being situated deeply in the cavity of the ham, in close relation with numerous important structures, is very difficult of access, especially in fat subjects. Fortunately it is seldom necessary to attempt is deligation, as wounds and traumatic aneurism here are of extremely infrequent occurrence. The artery is in intimate connection by its outer and posterior surface with the popliteal vein, from which it is not always easily detached. Sometimes the vein is double, and then the artery lies between the two trunks, closely and firmly embraced by them. The popliteal nerve is separated from the vessels by a thick layer of fat; superiorly it lies exterior to the artery, but as

it descends towards the leg it gradually winds round it to place itself along its internal border.

There are two points at which the popliteal artery may, if necessary, be exposed for the application of the ligature; these are its superior third and its inferior third. The middle portion of the artery is never interfered with, on account of its great depth, its near proximity to the knee-joint, the unyielding character of its lateral boundaries, and its intimate connection with the accompanying vein and nerve.

The artery may be ligated in the upper third of its extent, where it is more accessible than anywhere else, by carrying a vertical incision along the outer border of the semi-membranous muscle, for about three inches, extending down as far as the popliteal nerve. The muscle is then drawn inwards and the nerve outwards, when, by the cautious use of the forceps and handle of the knife, the vein and artery will be easily found, and must be gently and carefully separated from each other, the needle being passed from without inwards.

Fig. 214.



Ligature of the popliteal at its upper and lower parts *a*. The popliteal vein. *b*. The popliteal artery. *c*. The posterior saphenous vein. The popliteal nerve, on the outside of the artery, has been accidentally omitted in the diagram.

Exposure of the artery, in the lower third of its extent, may be effected by a vertical incision between the heads of the gastrocnemius muscle. Care is taken not to injure the posterior saphenous vein and nerve, which lie close by, but to draw them, along with the popliteal nerve, away from the knife. The artery will be found to be deeply imbedded in the ham, partially concealed by the popliteal vein, but projecting somewhat to its outer side.

In our attempts to expose the popliteal artery, care must be taken not to make too free a use of the knife, for fear of wounding the articular branches which are given off at a right angle, and which might, if injured, cause embarrassing hemorrhage.

LIGATION OF THE ANTERIOR TIBIAL.

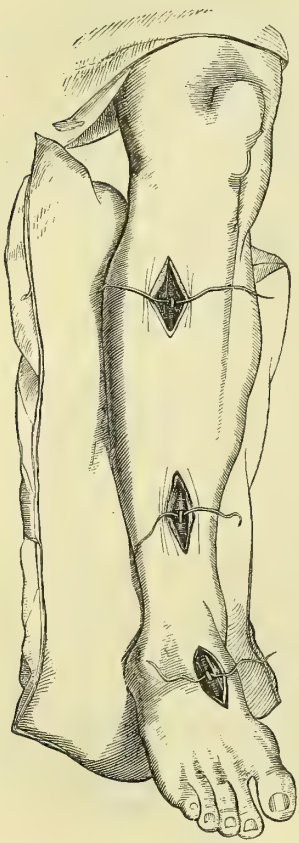
The anterior tibial artery may require to be tied on account of hemorrhage or traumatic aneurism, and the best plan always is to take the external wound as our guide to the seat of the injury. The vessel, whose course is indicated by a line drawn from the head of the fibula to the base of the great toe, may be secured at three different points.

The artery, in the superior third of its extent, lies underneath and between the anterior tibial and common extensor muscles, and may be exposed by a vertical incision, four inches in length, carried down in the direction of the line just mentioned. The skin and superficial fascia being divided, the aponeurosis is to be slit open upon a director to the

full extent of the outer wound; the two muscles are then to be separated from each other along their raphé, and the artery, which lies in close contact with the interosseous ligament, is surrounded with the ligature, care being taken not to injure the accompanying veins. The anterior tibial nerve is exterior to the vessels.

In the middle third of the leg, the relations of the vessel are essentially the same as in the upper, except that the long extensor of the toe is interposed between the anterior tibial and common extensor. The artery is still deep-seated, and a long incision is required for its full exposure. A branch of the peroneal nerve sometimes attaches itself to the artery here, and must be drawn away before passing the ligature.

Fig. 215.



Ligature of the anterior tibial, at various parts. The wounds are supposed to be held asunder. The ligature is under the vessel.

In the inferior third of the limb, the artery lies on the tibia, between the tendons of the common extensor of the foot and the proper extensor of the great toe, the latter overlapping it on the inside. The vessel here is, therefore, comparatively easy of access.

The dorsal artery of the foot, the continuation of the anterior tibial, may be easily tied in any portion of its extent, as it runs down across the instep, its course being indicated by a line extending from the centre of the ankle-joint to the posterior extremity of the first interosseous space. It lies under cover of the integuments and aponeurosis, and may readily be exposed by carrying the knife along the outer border of the tendon of the long extensor muscle of the great toe.

LIGATION OF THE POSTERIOR TIBIAL.

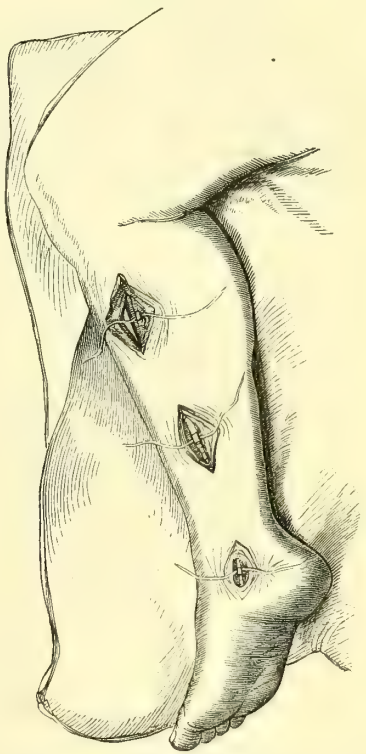
The posterior tibial artery occasionally requires ligation on account of wounds, and, if the operation be performed high up, the task is one of the most arduous and perplexing that a surgeon can be called upon to execute. It has fallen to my lot to tie it in this situation in two instances, and the difficulties in both were very great, having been increased tenfold by the confused condition of the parts, in consequence of the large quantity of extravasated blood. In one of these cases the artery had been laid open by a pistol ball, and in the other by a dirk-knife; the hemorrhage in both was profuse, and could only be effectually controlled by the ligature.

The situation of this artery is very deep; its course is at first

obliquely inwards, and then vertical, being indicated by a line extending from the inferior border of the popliteal muscle to the fossa between the heel-bone and the inner ankle. It is covered in the superior two-thirds of its extent by the gastrocnemial, soleal, and plantar muscles, but during the remaining portion it lies immediately below the integuments, except at its commencement, where it is slightly overlapped by the tendo-Achillis. It is accompanied and embraced by two veins, one being on each side of it. The attendant nerve lies internal to it in the upper part of the leg, but as it descends it crosses the artery superficially, and places itself along its outer margin. It is not without interest to know that the posterior tibial is sometimes double.

The artery may be exposed and tied in the upper and middle portions of its extent in one of two ways. The first consists in detaching the gastrocnemial muscle for about four inches along the inner border of the tibia, and cutting across the inner head of the soleal, by reflecting which we come directly down to the posterior layer of the aponeurosis of the leg, the free division of which brings the vessel at once fully into view. Care must be taken to avoid the internal saphenous vein, which runs close along the line of incision. In the other method, which was suggested by Mr. Guthrie, the artery is laid bare by a long, vertical cut, extending through the centre of the muscles of the calf. Its advantages are, first, that the artery, being more directly approached, is more effectually under our control, and, secondly, that there is less danger of bagging, if blood and pus are poured out. The length of the incision need not exceed that in the other operation, and the hemorrhage is generally insignificant.

Fig. 216.



Ligature of the posterior tibial, at various parts. The wounds are held asunder, and the ligature is under the vessel.

The posterior tibial sometimes requires ligation in the lower portion of its extent, between the heel and ankle. Taking its pulsation for his guide, the surgeon makes an incision, about two inches long, directly along its track, which is nearly midway between the two points here indicated. The direction of the incision should be somewhat curvilinear, with the concavity towards the inner malleolus. The artery here lies beneath three aponeurotic layers, which must be succes-

sively divided upon the director, when the needle is passed under the vessel from behind forwards, care being taken not to include the accompanying veins and nerve.

In consequence of the superficial situation of this artery in the lower portion of its extent, a convenient point is afforded between the inner malleolus and the tendo-Achillis for the application of pressure in the treatment of hemorrhage of the sole of the foot. The effect may be greatly increased if the circulation be also arrested in the anterior tibial, as may readily be done by placing a compress over it, just above the joint. A bandage is then extended from the toes upwards as far as the ankle, round which it is to be passed in the form of the figure 8, until the bleeding is completely arrested. Sometimes a metallic arch may be advantageously stretched across the front of the joint, one end resting upon each compress, the object being to ward off injurious pressure.

The two *plantar arteries* begin opposite the two heads of the abductor muscle of the great toe, being the terminal branches of the posterior tibial; they are deep-seated, and, when injured, are often a source of troublesome and annoying hemorrhage, owing to the remarkable freedom of their anastomoses. All precepts for exposing and tying these vessels, founded upon their anatomical relations, are useless. The best plan is to be guided by the external wound, and to provide an abundance of room with the knife, always taking care to cut in the direction of the length of the foot.

LIGATION OF THE PERONEAL.

The peroneal artery, after running a short distance, passes obliquely downwards and outwards to reach the fibula, along which it descends until it arrives near the outer malleolus, where it divides into its two terminal branches. It may be secured, in the upper portion of its extent, by making an incision, long and vertical, through the bellies of the gastrocnemial and soleal muscles; and inferiorly, as it runs along between the outer malleolus and tendo-Achillis, by a cut at least two inches and a half in length, directed upwards and outwards towards the fibula. The vessel here rests upon the interosseous ligament, under cover of the long flexor of the great toe, which must be detached as far as may be necessary from the bone, and drawn outwards.

CHAPTER VI.

INJURIES AND DISEASES OF THE VEINS.

The affections of the veins requiring to be noticed under this head are, wounds, hemorrhage, inflammation, varicosity, the formation of phlebolites, and the introduction of air.

SECT. I.—WOUNDS.

Of wounds of the veins not much need here be said, as they rarely exhibit any difficulty in regard to their treatment, or much danger in respect to their termination. Like wounds of the arteries, they may be produced by various weapons, and are, therefore, distinguished by different names, as incised, punctured, lacerated, contused, and gunshot. They are always followed by more or less hemorrhage, according to the size of their caliber, the blood issuing from them in a continuous stream, of a dark, purple color. When the division is complete, there is hardly any retraction, or annular constriction, and hence the bleeding often progresses until it proves fatal, especially if the vessel be large and superficial, as in wounds of the jugular and femoral, fainting not materially favoring the formation of a clot. Partial wounds, of whatever direction, will also bleed copiously, if they are at all extensive, and no mechanical obstacle is offered to the flow of blood. If the incision is small, exhibiting the character rather of a puncture than of a cut, the bleeding, after having continued for some time, will gradually cease, in consequence of the formation of a minute, but gradually increasing, clot upon the edges of the wound. These phenomena may often be witnessed in ordinary venesection at the bend of the arm, the clot adverted to constituting one of the impediments to the flow of the blood, and occasionally compelling the operator to open another vein. In gunshot wounds, severing a large vein, the hemorrhage frequently proves as suddenly fatal, or nearly so, as in corresponding lesions of an artery; or, life being preserved by the narrow state of the wound, or the valve-like disposition of its walls, the blood may be extensively, and perhaps most prejudicially, infiltrated into the intermuscular and subcutaneous cellular tissue.

The chief danger from wounds of the veins arises from loss of blood and inflammation of their tunics. The latter occurrence is occasionally observed as a consequence of the operation of bleeding at the arm with a foul or blunt lancet. In ordinary cases, however, there is but little risk of this kind, the parts readily uniting by adhesive action,

since there is no impediment to this process from the sanguineous current, as there is, under similar circumstances, in an artery: all is calm and quiet within, and hence the most extensive wounds are often repaired in an almost incredibly short time.

The *treatment* of a wounded vein is generally very simple, merely by compress and bandage, and attention to position. If seated superficially, we have only to bring the edges of the breach together in the usual manner, and the hemorrhage will generally cease at once, without any direct application to the vein itself. In the operation of bleeding, the only dressing commonly employed, after the necessary quantity of blood has been evacuated, and the edges of the puncture have been approximated, is a small compress, placed immediately over the part, and confined by means of a bandage; the slight inflammation which follows furnishes the requisite amount of plasma, and in less than twenty-four hours the union is generally so firm as to render it difficult to break it. The rule with all good surgeons is never to tie a vein, in any case, or under any circumstances, if it can possibly be avoided; not that such an operation involves any special difficulty, but because of its liability to be followed by severe inflammation, of a diffusive, erysipelatous character, tending to extend into the larger trunks and thence on towards the heart. Cases, nevertheless, occasionally occur, as in wounds and operations about the neck, axilla, groin, and thigh, where, from the extensive character of the lesion, and the impossibility of arresting the hemorrhage by compression, the ligature must be employed at all hazard; and it is gratifying to know that, although such a procedure is perhaps never entirely free from danger, yet it has often been crowned with the most complete success.

Rest is of great moment after wounds of the veins; it should be absolute, for the slightest motion may break up the adhesions, and thus endanger the part by inflammation. Exclusion of the atmosphere is also very desirable, and may be secured by compress and bandage alone, or by these means, aided by collodion.

SECT. II.—DISEASES OF THE VEINS.

Inflammation of the veins, technically called phlebitis, is occasionally an idiopathic affection; most commonly, however, it arises from injury, inflicted either directly upon these vessels, or indirectly through other structures. It frequently follows upon severe accidents and surgical operations, and, when this is the case, it is apt to give rise to pyemia, or multiple abscess, a disease which, as stated elsewhere, nearly always proves fatal. Phlebitis is a much more common affection than arteritis, and differs from this lesion still further in its liability to terminate in suppuration, which arteritis seldom does, the ordinary product of the latter being plastic matter, not pus. Another peculiarity of phlebitis is its tendency to extend along the vessels towards the heart, thus greatly increasing its dangers. Recent researches, however, render it probable that this tendency is much less frequent than was formerly imagined. The affection is sometimes

confined to one vein; but, in general, it involves a considerable number, either simultaneously or successively. In the former case, it is said to be circumscribed; in the latter, diffused. Finally, it may be acute or chronic.

1. ACUTE PHLEBITIS.

The symptoms of acute phlebitis are not always well marked. When the affected vessels are superficial, their course is generally indicated by the existence of a corresponding number of red lines, which, on applying the finger, feel like hard, rigid cords, exquisitely sensitive to the touch, and reaching from the seat of the injury up the limb as far as the eye can follow them. The discoloration, which varies from a faint, rosy tint to deep red, or even purple, according to the intensity of the morbid action, gradually diffuses itself over the surrounding surface, and eventually exhibits all the characters which distinguish that of erysipelas. Considerable swelling usually attends, not unfrequently pitting on pressure. The pain is of a sharp, smarting, or burning nature, and is generally so severe as to deprive the patient effectually of appetite and sleep.

The constitution always deeply sympathizes in phlebitis, even when of comparatively limited extent. The disease is often, if not generally, ushered in by chilly sensations, if not actual rigors, alternating with flushes of heat; the pulse is frequent, quick, and irritable; the skin hot and dry; the stomach nauseated and otherwise disordered; the bowels costive; the urine scanty and high-colored. If the patient was in ill health immediately prior to the attack, the symptoms usually will be of an adynamic character from the beginning; or, if not, they will soon become so. Excessive prostration, delirium, an icterode state of the countenance, gastric irritability, and great restlessness are usually prominent symptoms in every severe case of phlebitis.

Fig. 217.



Phlebitis; a section of the femoral vein, occupied principally by fibrous clots.

The *anatomical characters* of acute phlebitis are swelling, opacity, and pulpiness of the internal membrane of the veins, with uniform redness, varying from light pink to deep florid. The middle and outer coats soon become profoundly injected, and their proper substance, although at first preternaturally soft and humid, is at length rendered so dense and firm that the vein feels like a hard, contracted cord. The cavity of the inflamed vessel is filled with clotted blood (fig. 217), sometimes blended with pus or lymph, and in many cases it is lined by a false membrane, susceptible, under certain circumstances, of organization. Instances occur in which the pus is infiltrated into the substance of the vein, or collected into small abscesses beneath the serous lining. The pus of phlebitis is generally an imperfectly elaborated fluid,

containing a large quantity of plastic matter, and comparatively few characteristic globules.

Acute phlebitis is always a dangerous, and often a fatal, disease, few persons recovering when the morbid action is well established, or extensively diffused. This remark is true both of the traumatic and idiopathic forms of the disease; also of external and internal phlebitis, or of inflammation of the superficial and deep-seated veins. The pus, formed in the affected vessels, commingling with the blood, soon poisons the system, and thus renders the heart, brain, and spinal cord unfit for the performance of their functions.

The *treatment* of phlebitis cannot be conducted with too much caution. When the disease is situated superficially, an attempt should be made, by leeches, blisters, iodine, and nitrate of silver, to circumscribe the morbid action, and thus prevent the formation of pus. Such a result, however, is not to be expected when the disease involves the internal or deeper veins, where the inflammation often makes great, if not irreparable, progress before the surgeon is aware of its true character, and where, consequently, treatment of every kind is of little or no avail. All lowering measures are generally inadmissible, even when the patient is comparatively young and plethoric; debility, great and marked, is sure to arise, and to call imperatively for the use of tonics and stimulants. Purgatives are exhibited to clear out the bowels and correct the secretions; and mercury is given in frequent and liberal doses with a view to early and decisive constitutional impression, the best form being calomel, or calomel and blue mass. The addition of morphia will be required for the threefold purpose of preventing undue purgation, allaying pain, and inducing sleep. The best stimulants are milk punch, quinine, and iron, especially the tincture of the chloride.

If abscesses form, their contents must be evacuated by early and free incisions; the internal organs must be diligently watched, and any complications that may arise must be met by appropriate measures.

2. CHRONIC AFFECTIONS.

The characters of chronic inflammation of the veins differ considerably from those of the acute form. The coats of the vessels are usually so much thickened, hypertrophied, and indurated as to preserve, when cut across, their cylindrical figure, like an artery. The redness is of a brownish tint, interspersed with numerous shades of gray, violet, or purple; and the inner membrane, which is rough and shrivelled, can easily be raised in large opaque shreds. In some instances, the vein is dilated, or contracted, obstructed with clotted blood, lined by lymph, or filled with pus.

The disease sometimes passes into *ulceration*, but the occurrence is much less frequent than in the arteries. Commencing most commonly at one or more points of the inner membrane, it gradually extends to the other tunics, which it sometimes completely erodes. The immediate effect of this accident is an effusion of blood, which may be so great as to produce fatal results. The ulcers, which affect various forms,

are occasionally quite numerous, and spread over a large extent of surface.

Chronic phlebitis is observed chiefly in the veins of the inferior extremity, and in those of the spermatic cord and of the ano-rectal region, as a complication of hemorrhoids. The principal symptoms are pains, of a sharp, pricking, or dull aching character, tenderness on pressure, and a sense of fulness or distension at the seat of the disease. The treatment is gently antiphlogistic, removal of the exciting cause constituting an object of primary importance.

There are certain states of the system in which the veins attain a very great size, and, consequently, carry an inordinate amount of blood. This *hypertrophy*, for so it may be termed, is very conspicuous in chronic affections of the joints, and in various kinds of tumors, both vascular and malignant. It is always conjoined with hypertrophy of the arteries, and forms one of the most serious obstacles to the cure of certain diseases.

Obliteration of the veins is by no means uncommon, and is almost always the result of inflammation. Sometimes it is caused by the pressure of a tumor forcing the sides of the vessel closely in contact, and so converting it into a dense, ligamentous cord. The largest veins are sometimes thus obliterated. Such a condition is extremely apt to be followed by dropsical effusions and other ill effects inimical to health and life.

Loose concretions, *phlebolites* or vein-stones, as they are termed, varying in size from a currant to a pea, are occasionally found in the interior of these tubes. Commonly of a yellowish, brownish, or bluish color, they are of a hard and brittle consistence, and of an oblong, oval, or spherical form, with a smooth, even surface. When divided, they are found to be made up of several thin but distinct lamellæ, disposed concentrically around a small delicate nucleus, frequently consisting of fibrin. The number of these concretions is extremely variable; occasionally as many as ten, twenty, or even thirty are observed. They are generally met with in the smaller veins; more frequently, perhaps, in the spermatic, uterine, vaginal, vesical, hemorrhoidal, and splenic, than in any other. In the saphenous and its branches, they often exist in connection with varicose enlargement. Their composition is principally phosphate and carbonate of lime, with a small amount of animal matter, probably albumen, and a trace of oxide of iron.

SECT. III.—VARIX.

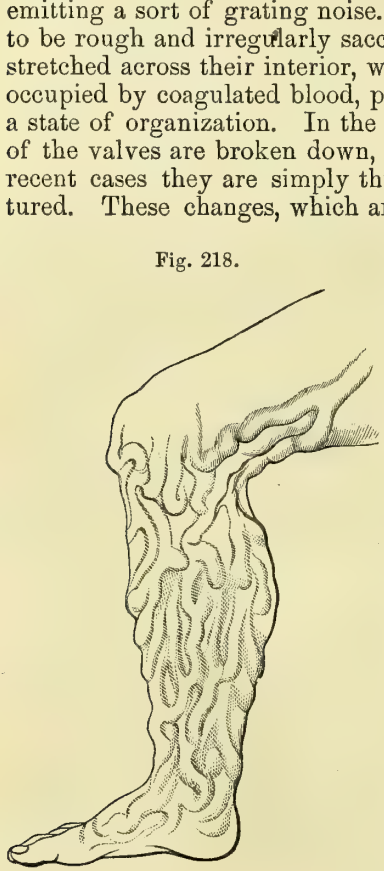
A varicose and dilated state of the veins is by no means uncommon, especially in the lower classes of working people, and in mechanics whose avocation compels them to maintain habitually the erect position. The veins which are most liable to suffer in this respect are those of the inferior extremity and of the spermatic cord, but those of the abdomen, scrotum, vulva, trunk, and face are also occasionally implicated, while those of the superior extremity are almost exempt from the disease. Of the deep-seated veins, those most fre-

quently affected are the jugular, azygos, subclavian, and hemorrhoidal. I have met with quite a number of cases where there was apparently a varicose diathesis, almost all the principal veins in the body being abnormally tortuous and dilated.

Age seems to exert a remarkable predisposition to this disease. Thus, varicose enlargement of the spermatic veins is most common in young men soon after the age of puberty; while, in the inferior extremity, the greater number of cases occur after the thirtieth year. In the hemorrhoidal veins, the malady is most frequent in elderly subjects.

The veins, in this disease, are preternaturally large, tortuous, knotty, and convoluted, or as if they were folded upon themselves, being augmented both in diameter and length, and observing a singularly serpentine course as they proceed to their place of destination. Their coats are hard, dense, and elastic, rolling under the finger like fine cords; with, here and there, a portion that retains its normal characters, or that is uncommonly thin and expanded, as if it were ready to give way under the slightest exertion. In cases of long standing, they frequently offer a good deal of resistance to the knife, perhaps even emitting a sort of grating noise. On being laid open, they are found to be rough and irregularly sacculated, strong bands being sometimes stretched across their interior, which divide the tube into small cells, occupied by coagulated blood, phlebolites, or fibrinous concretions, in a state of organization. In the advanced stages of the disease, many of the valves are broken down, if not completely destroyed, while in recent cases they are simply thickened, indurated, displaced, or ruptured. These changes, which are generally most conspicuous in the internal saphenous vein and its branches, are obviously brought about by chronic inflammation, or by repeated attacks of the acute form of that disease, and often lead to great and irreparable mischief. Occasionally, the affected vessels are converted into dense, rigid, and impervious cords, altogether disqualified for the discharge of their functions.

Fig. 218.



The state of the vessels here described is well depicted in the adjoining cut (fig. 218), the drawing of which was taken from a patient of mine, a stout, robust, laboring man, upwards of fifty years of age. The enlargement, which was much greater than I ever saw it before, was principally situated on the inner surface of the limb, and was associated with similar disease of the veins of the scrotum, penis, and abdomen.

The disease in question may be caused in various ways. In the inferior extremities of pregnant females, it is generally induced by the pressure of the distended uterus, creating a mechanical impediment to the return of the blood in the iliac veins, and, indirectly, in the saphenous. Wearing tight garters, drawers, or stockings, may also occasion the disease, and a similar effect is brought about by the habitual maintenance of the erect posture. Hence, the disease is very common in persons who are compelled to stand much. Varix of the hemorrhoidal veins generally depends upon habitual distension of the rectum and frequent straining in defecation. The causes of varicocele are still imperfectly understood, although there is reason to believe that the disease is most commonly developed under the influence of onanism, and other mechanical obstruction calculated to weaken the spermatic veins.

A natural predisposition to varicose enlargement occasionally exists in certain individuals; the veins seem to be unusually large and feeble, and to become tortuous and dilated under the most trifling obstacles to the onward movement of their contents. When this is the case, the disease often occurs simultaneously in different parts of the body, superficial as well as deep.

The *effects* of varicose veins vary according to the situation of the malady. In the legs, the pressure of the enlarged and distended vessels is always productive of a good deal of pain, of a pricking or stinging nature, of tumefaction of the skin and cellular tissue, and of more or less tenderness along the track of the affected veins. In the more aggravated cases, ulceration of the integuments is apt to take place, commencing usually at one particular spot on the inner surface of the limb, and gradually progressing until a large sore is established, called, from this circumstance, the varicose ulcer, which it is always difficult to heal, and which occasionally extends into the enlarged veins, thus causing copious, if not fatal, hemorrhage. In the spermatic veins, the disease may give rise to atrophy of the testicle, and to distressing neuralgic pains; while in the hemorrhoidal it leads to the formation of piles, and other disagreeable symptoms.

Although the development of varix is generally slow, yet cases occasionally occur in which it progresses very rapidly. During the latter months of utero-gestation, the veins of the feet, legs, and thighs often attain an enormous bulk in a few weeks, and I have seen repeated instances of a similar kind in the spermatic and hemorrhoidal veins. In the inferior extremity, the disease, after having gone on for some time, often remains stationary for an indefinite period, neither perceptibly advancing nor receding. In some instances, it undergoes a sort of spontaneous cure; that is, inflammation is set up in the affected veins, and, this being followed by the formation of fibrinous concretions, their caliber is ultimately rendered completely impervious, thus compelling the blood to seek other channels. Instead of this favorable result, the inflammation sometimes leads to erysipelas, abscess, and even death. Varicocele never proves fatal, nor does varix of the hemorrhoidal veins, although both are, at times, a source of severe suffering.

Treatment.—The treatment of varix resolves itself into palliative and radical. The former consists, as the term implies, of the removal of the exciting cause of the disease, and the adoption of such remedies as are calculated to relieve the part and system of suffering without positively curing the malady. In varicocele, onanism must be interdicted; in varix of the hemorrhoidal veins, straining and constipation must be counteracted; and in varicose enlargement of the veins of the lower extremity, all sources of constriction must be removed, together with whatever else has a tendency to weaken, irritate, and inflame the diseased structures, and thereby occasion further enlargement. Giving artificial support to the affected veins often has a good effect. Hence the use of the suspensory bag in varicocele, and of the laced-stocking in varix of the saphenous veins. In nearly every form of the lesion, great benefit accrues from the occasional administration of an active purgative, which, by clearing out the bowels, thus affords a freer passage of the blood in the diseased veins towards the heart. If the patient be very plethoric, he may sometimes lose blood with advantage. In varix of the legs, nothing generally affords more prompt and satisfactory relief than a good bleeding at the arm; and the same remedy must be called in requisition, along with astringent and anodyne lotions and perfect rest of the parts, when the veins are unusually tender and painful from an accidental access of inflammation.

For the *radical cure* of this disease numerous operations have been devised, a few only of the more important of which need be noticed here, as the rest have either fallen into merited neglect, or are too dangerous to justify their repetition. Besides, the claims of these different operations will more naturally come to be considered when we speak of the several varieties of varix, as varicocele, and hemorrhoids. There are really but two operations which, according to my experience, should ever be resorted to for the permanent relief of this disease; these are the ligature and the caustic issue; and if we apply these remedies to individual forms of the lesion, we shall find that the former is exclusively adapted to varicocele and hemorrhoids, and the latter to varix of the feet, legs, and thighs. Both procedures are extremely simple, but simple though they be, I make it an invariable rule not to employ them without a thorough and protracted preparation of the part and system; and I deem this the more necessary, because, in the great majority of cases upon which we are obliged to operate, the disease is rather an inconvenience than a serious evil, threatening loss of limb and life. I will not pretend to assert that there are no cases of varix where an operation is not absolutely necessary; to do this would be absurd; I know that there are many such cases; what I mean to say is simply this, that no man, however skilful or experienced, should endanger his patient's life without due reflection, or by rushing headlong into measures which, if injudiciously used, may lead to the worst results. The preliminary treatment should be mild but of longer duration than in ordinary diseases; the object is to remove any irritation that may exist in the affected veins, to soothe and calm them, in order that they may be the better prepared to withstand the rude assault about to be made upon them. To ac-

complish this object the patient must be subjected to light diet, to a course of gentle purgation, and to almost absolute rest in the recumbent or semi-erect posture, for at least a fortnight. This is the more important if he be plethoric, intemperate, or very excitable. When it is remembered how intolerant the veins are of injury, and how resentful they are of surgical interference, such precautions cannot be considered as idle.

The operation with the ligature is either direct, as in piles, or subcutaneous, as in varicocele, and in either case it is as safe as it is effectual. The principle on which it operates is that of strangulation, by which the enlarged vessels are converted into a slough, which is subsequently detached by ulcerative action. For this purpose it is necessary to draw the cord with great firmness, so as to produce the result in question in the shortest possible period, as well as with the least suffering. When the ligation is direct, as in hemorrhoids, it is always necessary to encircle the base of the tumor, or tie it as near as practicable to its point of attachment to the bowel. When the base is unusually large, it is sometimes transfixed with a needle armed with a double ligature, one of which is then drawn around each half of the morbid growth, the object being its more effectual strangulation. The subcutaneous operation is particularly applicable to varicocele, to which, in my judgment, it ought to be exclusively limited. It is performed by means of a stout spear-pointed needle and a strong ligature, introduced in such a manner as to avoid the spermatic cord, the instrument making only two punctures, one in front of the scrotum and the other behind, by retracing its steps after it has effected transfixion. The ends of the cord are then firmly tied in the usual manner, the pressure being increased from day to day until the ligature is detached.

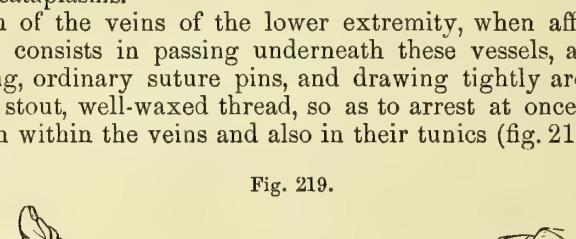
In operating upon the veins of the extremities, I give a decided preference to the issue prepared with equal parts of caustic potassa and quicklime, carefully incorporated with each other, and converted into a thick paste with alcohol. Of this, a portion of the size and shape of a three cent piece, and from one to two lines in thickness, is placed directly upon the enlarged and tortuous vessel at intervals of three, four, or five inches, and allowed to remain on for fifteen minutes, by which time a deep eschar will have formed. The paste is now removed, and the part being carefully washed with vinegar, to neutralize any of the alkali that may still adhere to the surface, is covered with an emollient poultice, for the purpose of promoting, first, the separation of the eschar, and, secondly, the development of granulations. The cure is usually somewhat tedious on account of the length of time required to heal the issues, but it possesses the great advantage of being entirely free from danger and always perfectly successful.

The after-treatment is not to be disregarded in these operations. The great danger is a bad form of erysipelas, connected, doubtless, with phlebitis, its tendency being to diffuse itself extensively over the system, and to give rise to typhoid symptoms. I have not myself, however, witnessed any such effects in any of my cases, and I am inclined to ascribe my good fortune more to the pains which I have always taken to prepare my patients than to any particular skill in

performing the operation or in conducting the after-treatment, though no one could be more careful about this than I am. If everything goes on well, little else will be necessary than strict attention to the diet and quietude of the part and system, with an occasional purgative; if erysipelas supervene, calomel, opium, and quinine will be indicated, along with milk punch, and the application of iodine, astringents, and emollient cataplasms.

Ligation of the veins of the lower extremity, when affected with varicosity, consists in passing underneath these vessels, at different points, long, ordinary suture pins, and drawing tightly around each of them a stout, well-waxed thread, so as to arrest at once the circulation both within the veins and also in their tunics (fig. 219). Great

Fig. 219.



Obliteration of varicose veins by ligation.

care must be taken that the pins are carried fairly behind the vein; if they transfix the vessel, very serious consequences may arise from phlebitis; whereas, if the procedure be properly executed, it will generally be harmless, although not, as already observed, as devoid of danger as the operation by caustic. The after-treatment requires great attention. The pins should not be removed until considerable ulceration has taken place, which will rarely be before the end of the sixth or eighth day.

SECT. IV.—INTRODUCTION OF AIR.

A fatal, though, fortunately, not a common accident, incident to certain operations, is the spontaneous introduction of air into the veins. It is most frequent in operations about the neck, face, and axilla, and was first noticed, as a distinct occurrence, in 1818, by Mons. Beauchesne, in exsecting a tumor from the neck of a young man, in which it was necessary to disarticulate and raise the clavicle. At the moment of effecting this, the patient became faint, and, exclaiming that he was dying, expired in less than half an hour afterwards. The examination of the body revealed the existence of an aperture in the internal jugular vein, at its junction with the subclavian, through which the air, causing the fatal result, had doubtless entered the circulation. Shortly after this, the accident happened to Dr. Mott and Dr. Stevens, as well as to several European surgeons, so that, in

due time, the attention of the profession became fully aroused to the nature and importance of the subject.

The disastrous effects of the introduction of air into the venous circulation were known, long ago, to Wepfer, Vander-Heyden, and other physiologists; but they were lost sight of, in great measure, until attention was recalled to the subject by the experiments of Bichat, Nysten, and Magendie, who showed that a very small quantity of this fluid, suddenly injected into the jugular vein of dogs and other animals was sufficient, in most cases, to cause death almost instantaneously. On the other hand, it has been found that a large quantity, as, for example, several cubic inches, will not destroy life, if it be introduced slowly, the air, in this case, combining with the blood in such a manner as to prevent it from producing any serious mechanical inconvenience. Upon dissection, air is readily discovered in the cavities of the heart, as well as in other parts of the circulatory apparatus, thus accounting satisfactorily for the fatal event.

The *symptoms* which characterize the entry of air into the venous system are essentially those of cerebral apoplexy. The patient is generally seized, suddenly and unexpectedly, in the midst of the operation, with a sense of faintness, or a horrible feeling of terror, oppression, and exhaustion, inducing him to believe, and perhaps to exclaim, that he is dying. The countenance, in a moment, assumes a dark, livid hue, the body is agitated with convulsive movements, the breathing is slow, difficult, and stertorous, the muscles are completely relaxed, the pulse is feeble and almost imperceptible, the pupils are dilated, and the individual is wholly unconscious. In short, he dies in a state of profound coma, like a person in a fit of apoplexy. On applying the ear to the cardiac region, the action of the heart is found to be excessively oppressed, the organ struggling powerfully to overcome the mechanical obstruction caused by the admixture of the gaseous and sanguineous fluids, which, swept slowly and heavily along over the fleshy and tendinous columns, occasions a loud, churning noise, synchronous with the contraction of the left ventricle, and at the same time a peculiar thrill, or vibratory sensation, perceptible by the hand as it rests upon the chest.

Such are the effects which are usually observed when air has been introduced suddenly, even in small quantity, into the venous circulation; and there is a strong probability that they will steadily increase in severity until they prove fatal, despite the most judicious and energetic measures that may be employed to counteract them. The period at which death occurs varies from a few minutes to several hours; in some cases life is destroyed almost with the rapidity of lightning, and in most cases in from twenty to forty-five or fifty minutes. The fatal event, if not instantaneous, is always preceded by a rapid reduction of the temperature and a diffusion of the lividity over the whole body, the surface being of a leaden hue, as in death from asphyxia. Cases have been noticed where, after the symptoms had continued for some time in a very bad form, the purplish appearance of the cheeks was suddenly replaced by a reddish tinge, affording evidence, although gene-

rally of a deceptive character, of speedy reanimation and ultimate recovery.

The immediate cause of death, in this accident, has been variously explained; indeed, it is remarkable what little coincidence of opinion there is upon the subject among writers. From the fact that air has occasionally been found in the right cavities of the heart, after surgical operations in man, and in animals after experiments, it has been assumed that it was the inability of this organ to contract upon its contents, and thus send a sufficient quantity of blood to the lungs and brain for the due performance of their functions. Others have maintained that the primary trouble is in the pulmonary tissues. Thus, Mr. Erichsen supposes that it depends upon the manner in which the air and blood are beaten up together in the right cavities of the heart into a spumous fluid, which is unable to pass through the lungs, thus depriving the brain and spinal cord of their due supply of blood, and inducing fatal syncope, usually attended with convulsions. In opposition to this view, it may be stated that, if air be injected in considerable quantity into the carotid artery of an animal, all the phenomena of apoplexy, such as stertorous breathing, loss of sensibility, and spasmodic rigidity of the muscles, will instantly be produced, and soon occasion death from obstruction of the cerebral circulation. Whatever of truth these different explanations may embody, it is evident that the secondary effect of the presence of the gaseous fluid, that which really causes the fatal termination, is the want of a sufficient quantity of oxygenated blood in the great tripod of life, the heart, lungs, and brain.

If the patient survive, the transition to health is seldom instantaneous; on the contrary, several hours generally elapse before he recovers his consciousness and strength. In a case mentioned by Dr. Warren, the man, after having lain in a state of insensibility for two hours and a half, awoke as if from a profound sleep, still breathing, however, like an apoplectic. The night was passed without any accident, and, on the following morning, he was as well as usual, except that he had a headache and some soreness in the chest. Sometimes the patient recovers from the immediate consequences of the accident, but dies afterwards from pneumonia, produced, probably, by the irritating effects which the fluid exerts upon the pulmonary capillaries, and through them upon the air-vesicles. Such an occurrence, however, is infrequent.

The local phenomena accompanying the introduction of air into the veins are of great interest, particularly in their diagnostic relations. In general, there is some noise, or sound, so loud and distinct as to be plainly perceived by the operator and his assistants, and which, occurring in combination with the sudden distress of the patient, is of the utmost value as a means of discrimination. In some cases, the sound is of a hissing nature, like that arising from air rushing into a narrow and exhausted receiver; in some, it is bubbling, clucking, or lapping; in some, gurgling, sucking, or licking. The immediate causes of these variations are, the size, shape, and situation of the opening in the injured vein, the quantity of blood in the wound, and the volume of the vessel and the relation which it bears to the surrounding parts.

Whatever may be the nature of the sound, or the degree of its intensity, it cannot, when once heard, be forgotten, and is always clearly characteristic of the accident. In addition to this phenomenon, there is occasionally, but by no means constantly, an appearance of bubbles of air about the wound in the vein, especially if it be somewhat deep-seated.

The veins through which air is usually spontaneously admitted in surgical operations are those about the neck, particularly the external and internal jugular and their immediate branches. It may also enter by the veins of the face, the axilla, and the chest. Thus, in one of Dr. Mott's cases, it passed in through the facial vein during the extirpation of an enlarged parotid gland. Dr. Warren met with an instance in which it was introduced by the subscapular vein; Clemot saw it enter by the veins of the chest; and Delpech had a case where it gained admission by the axillary vein. In operations on the trachea, and in the removal of tumors from the anterior part of the neck, the veins lying in this region might easily be wounded so as to let in air.

The reason why the veins in the localities here enumerated are alone subject to this accident is that they are under the influence of a suction action during inspiration, owing to a tendency to the formation of a vacuum within the chest during the expansion of the lungs. This action is naturally limited to the veins at the root of the neck, and it is here, therefore, that air is most liable to be introduced spontaneously; it may, however, as has already been stated, pass in through the veins of the face, axilla, and thorax, but that it may do so it is necessary that these vessels should be found in the condition of rigid tubes, or in a state of canalization, as it has been termed; for if they are merely collapsed, flattened conduits, it is evident that the air will not be able to enter them, however freely they may be punctured. There are various circumstances which may induce this accidental canalization of a vein, of which the principal are the adhesion of its walls to the parts through which it passes, and the manner in which it is held during the operation, rendering it open-mouthed and gaping when divided. Sometimes the introduction takes place in a perfectly healthy vessel at a considerable distance from the root of the neck, in consequence of the tension into which it is thrown by the position of the head and arm, as happened in one of Warren's cases, where the air was admitted by the subscapular vein. The probability of this occurrence is much increased when operations are performed upon the neck, face, and axilla, for the removal of large tumors, especially such as are of a glandular nature, including considerable-sized veins. In injury of the jugular veins the accident will be most likely to happen if the wound be made just above the clavicle, where the suction action is naturally strongest. Air thrown into veins in remote parts of the body will destroy life as promptly and effectually as when it enters in the localities above alluded to, and the only reason why the accident does not occur in them is that the vessels are not under the immediate influence of the respiratory organs, as they are about the neck and chest. Legallois witnessed three cases of instant death in female

animals from the introduction of air into the inferior cava and heart by the uterine veins.

Treatment.—The treatment of this accident is preventive and curative. For the former, different plans have been suggested, most of which may occasionally be adopted with advantage. In the first place, the operator should remember where, and under what circumstances, such an occurrence is most likely to happen; for, being thus put upon his guard, he will be more cautious in the movements of his knife, and thereby, in all probability, altogether avoid the much dreaded mischief. Secondly, when he is about to begin his incisions, he should request an intelligent assistant to compress at the root of the neck any veins that may be within reach, and, consequently, in danger of being injured in the early stage of the procedure. In conducting the deep dissection, he should make careful use of the handle of the scalpel, as well as of his fingers, to detach the morbid structures, or to separate the sound, as the case may be, and if he finds that any veins are included within them, so as to require to be severed, he should secure them at once with the ligature at the cardiac side of the tumor. Sometimes a temporary ligature may be proper, to be removed, or tied, after the completion of the operation, according to the exigencies of the case. It has been recommended that, when we are compelled to divide any of the vessels about the neck, the patient should be desired previously to make a full inspiration; such a procedure, however, would hardly be safe unless the vessel should become instantly collapsed, and remain so afterwards. Thirdly, in operating in the different regions under consideration, care must be taken to avoid those positions of the head and arm which are calculated to produce tension and canalization of the veins. Fourthly, it having been found that the entrance of the air into the veins can be prevented in the inferior animals by compressing the chest and abdomen, Mr. Erichsen strongly insists upon the propriety of swathing the body as tightly as the comfort of the patient will admit, with a view of compelling respiration solely by the diaphragm. Not having any experience with this plan, I am not able to give any decided opinion respecting it; but I should be disinclined, on principle, to adopt it, especially if the patient required the use of an anæsthetic during the operation. Lastly, should the accident happen, notwithstanding every possible precaution, as indicated by the occurrence of the peculiar hissing, clucking, lapping, or gurgling noise, previously mentioned, or by the appearance of bubbles about the wound in the vein, compression must instantly be applied, and all further proceeding abandoned until the trouble is effectually remedied.

To recover a patient from the effects of this accident, various methods of treatment have been proposed, some of which are, to say the least, anything but philosophical. The idea of sucking out the air from the injured vein, a plan proposed by some French surgeon, by the introduction of a suitable instrument, such as a silver canula, or catheter, amounts to little less than a positive absurdity; for, independently of the difficulty and tediousness of such an operation, it would be far more likely to be followed by an additional introduction

of air than the abstraction of that which has been already admitted. But, even granting, for the sake of argument, that a tube could readily be passed into the vein without the risk of letting in more air, it would not be practicable to remove the fluid from the lungs, which it must necessarily reach within a few seconds after the occurrence of the accident. Once admitted, no skill can dislodge it, either by this or any other means. When the patient is plethoric, and has lost but little blood during the operation, it has been recommended to open the temporal artery, on the ground that it might have the effect of removing cerebral and pulmonary congestion, and thus favoring the restoration of the circulation. The utter futility of such a procedure must be apparent, when it is recollected that this congestion depends, not merely upon an imperfectly aerated blood, but upon the presence of a spumous fluid, which the capillaries are incapable of propelling onward. The same remarks are applicable to the section of the right jugular vein, which, it has been alleged, might prove beneficial by unloading the corresponding cavities of the heart.

What, then, since the above modes of treatment are unavailing, is to be done for the restoration of the patient? Are there any means upon which we can place any reliance with a fair prospect of success? So far as I know, there are not, and hence our chief, if not sole, dependence must be upon the adoption of such means as may be best adapted to support the system under the terrible depression under which it is laboring. With this view, the treatment should be conducted very much upon the same principles as in syncope from loss of blood, or asphyxia from drowning. The patient is laid at once recumbent, with the head and shoulders lower even than the rest of the body, and, if the circulation be still going on, firm pressure is immediately applied to the axillary and femoral arteries, for the purpose of allowing as free an access of blood to the heart and brain as possible. Sinapisms of the most powerful kind are applied to the extremities, the precordial region, and the spine, in its whole length, and the body is wrapped up in blankets, wrung out of hot water, at the same time that cold air is freely admitted to the nose and mouth. If the patient is able to swallow, he must be made to take brandy and ammonia, otherwise these fluids must be promptly injected into the rectum. Finally, as a dernier resort, artificial respiration should be established, by means of a tube, introduced through the glottis, or through an opening in the larynx, and steadily and faithfully maintained, if necessary, until some time after all signs of breathing and circulation have disappeared.

CHAPTER VII.

AFFECTIONS OF THE CAPILLARIES.

THE capillaries are liable to enlargement, consisting of a species of hypertrophy of their tunics, with more or less dilatation of their caliber. The disease may be limited to the arterial capillaries alone, to the venous capillaries alone, or it may involve both classes of vessels, constituting thus a kind of compound affection. However this may be, the consequence of the enlargement is the formation of a distinct tumor, which may eventually acquire a large bulk, and seriously compromise the safety of the patient, especially when it is of an arterial character. In many cases, if, indeed, not in all, the disease is congenital, having, perhaps, already made considerable progress at birth.

SECT. I.—ARTERIAL TUMORS.

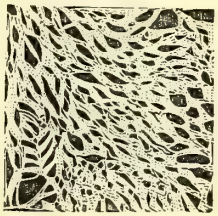
The only arterial tumor, properly so-called, that can be recognized, in a practical sense, is that which was originally so ably and graphically described by the late Mr. John Bell, of Edinburgh, under the name of aneurism by anastomosis. His account of the disease is by far the most clear and elaborate that has yet appeared, and it is remarkable that hardly anything of importance has been added to it by subsequent observers, either as it respects its anatomy, etiology, or mode of treatment. The only error which the Scotch surgeon committed was the assertion that the lesion was peculiar to adults, and that it was a perfect aneurism.

The most common sites of the arterial tumor are the scalp, lip, nose, orbit, eyelid, cheek, and chin; it may, however, occur in any part of the body, and I have repeatedly met with it upon the shoulder, trunk, fingers, and foot. Some years ago, I removed a considerable tumor of this kind from the big toe of a young man of twenty-two. I have also seen examples of the disease in the vulva of young girls. The texture in which it is usually situated is the cellular, especially the subcutaneous and submucous; I do not recollect ever to have seen it anywhere else, though its occasional occurrence has been noticed in the liver, spleen, and kidney.

This tumor is essentially composed of a network of arteries and veins, closely connected together by cellular, or cellulo-fibrous tissue (fig. 220). It is, in fact, originally nothing but a species of hypertrophy of the capillary vessels, commencing in a little speck, perhaps, not larger than the head of a pin, and going on gradually

enlarging until, at length, it acquires an enormous volume. The arteries, which are free from the earthy and fatty degeneration, have a singularly convoluted arrangement, and, in cases of long standing, or of extraordinary bulk, some of them are often as large as a small goose quill; their walls are disproportionably thin and diaphanous, and from being pressed out laterally into short, blind pouches, it is very common for them to have a sacculated appearance. This increase in the caliber of the arteries is not limited to the tumor, but always extends some distance beyond its proper boundaries, as can readily be ascertained by a careful examination with the finger; in fact, it is sometimes easily detected with the naked eye. The general disposition of the veins is similar to that of the arteries; they are, however, usually less capacious, relatively considered, and hence the blood returns with less facility than in parts naturally constituted.

Fig. 220.



The tissue by which the vessels are connected together, is, in the first instance, nothing but ordinary cellular substance, naturally existing in the part where the tumor is developed; it is perfectly soft, spongy, and extensible. In time, however, it necessarily undergoes important changes, brought about by the pressure exerted upon it by the impetuosity of the inflowing blood, and by its temporary sojourn in the midst of the morbid mass. Hence it is that, while in some situations it exists most sparingly, so much so, indeed, as to be hardly demonstrable, in others it is preternaturally abundant, and truly cellulo-fibrous.

Such are the grosser elements of this form of tumor. Examined more minutely, it is found to consist of a kind of areolar structure, the cells of which, varying in size from that of the smallest pin's head to that of a pea, freely communicate with each other, not unlike those of a sponge, by means of lateral pores. These cells, which exhibit every diversity of shape, are formed apparently by the ampullar expansions of the coats of the arteries, and bear, in their general character, a considerable resemblance to those of the erectile organs, as the penis and clitoris. In old tumors of this description, some of the sacs occasionally become closed, thus assuming, as it were, an independent existence. The cause of this occurrence is probably inflammation, leading either to direct adhesion of the contiguous surfaces of the arteries, or to the formation of coagula. The contents of these cysts are either serous, sero-sanguinolent, or sanguineous. In the latter case they are generally solid.

Finally, the arterial tumor has no distinct, separate envelop; the only covering which it has is derived from the superincumbent structures, as the skin or mucous membrane, which, in time, become atrophied by the incessant beating of the blood beneath, and ultimately give way by ulcerative action. In general, the surface of the tumor is of a reddish, scarlet hue, with, here and there, a purple spot, and so transparent as to allow many of the enlarged vessels to be seen through

it. Occasionally a few granules of adipose matter overlie the tumor, or are dispersed through its substance.

It will thus be perceived that this tumor is in reality not a true aneurism, preceded and accompanied by the fibrous, earthy, or atheromatous degeneration, but simply an abnormal dilatation of the capillary arteries, involving, in time, the larger arteries in their immediate vicinity, and attended by a corresponding but less developed state of the capillary and adjacent veins. It consists, in fact, clearly and distinctly, in a hypertrophied condition of these vessels; or, in other words, as was previously remarked, in a gradual evolution and growth of arteries and veins from tubules that are imperceptible by the naked eye to vessels of extraordinary size. There is no addition of new vessels, but the whole tumor is formed out of those which naturally exist in the part, enlarged in every direction, in length as well as in diameter, under the pressure of the increased and ever-present afflux of blood. The coats of the vessels are not, it is true, as thick and firm as those of arteries and veins, properly so-called, usually are, but the aggregate capacity is so much greater than what the part naturally possesses that it must be regarded as a product of supernutrition, and nothing else.

The origin of the arterial tumor is often ascribed to the effects of external violence, as a blow or fall, and that it may occasionally be so excited is highly probable; in general, however, it arises without any assignable cause, as a nevus, or mother-mark. Indeed, I am inclined to think that the affection is nearly always congenital, even in those cases in which it is said to have begun in the adult. This may be accounted for on the assumption that the nevus was originally so exceedingly minute as to have entirely escaped attention, until it began to assume an active character. However this may be, the starting-point of the disease is usually a little reddish speck, not larger than the head of a small pin, perfectly free from pain, and seated just beneath the skin, or partly in the skin and partly in the subcutaneous cellular tissue. Its growth is generally very gradual, so that a number of months, and perhaps even several years, may elapse before it attains the volume of a pigeon's egg. Occasionally, however, it increases with great rapidity, and soon acquires a frightful bulk. Of this occurrence I had a striking illustration, not long ago, in a female child, thirteen months old. At birth a reddish spot, as large as a dime, was observed at the centre of the left cheek. At the end of five weeks it had nearly doubled its dimensions; a quack now applied some caustic substance, eventuating in a large slough. The sore, which was the seat of occasional hemorrhage, healed in a little more than two months, leaving an unseemly scar, upwards of two inches in diameter, with red, spongy edges. A year after the use of the escharotic, when I first saw the child, the tumor was of immense volume, horribly disfiguring the features, and occupying the whole of the left side of the face, extending forwards to the nose and mouth, upwards to the eyelid and temple, backwards behind the ear, and downwards into the neck, its antero-posterior diameter being eight inches and a half, and the vertical six. The tumor, of a bluish color,

was of a soft, spongy consistence, and sensibly increased whenever the child cried, laughed, sneezed, or coughed. At its lower and back part it had a peculiar aneurismal thrill and bruit, synchronous with the action of the heart. During the last few months the inside of the cheek had become much enlarged, and now presented a knotty feel and bluish appearance. The upper jaw, along its alveolar process, was of unusual size, evidently from the same cause, and was beginning to encroach seriously upon the mouth. The swelling was free from pain, and there was no disorder of the general health.

In general, however, the tumor proceeds more slowly, and it is not uncommon to meet with cases, in which, after having made some progress, it remains for a while stationary. When it begins as a nevus, it is not unusual for it to continue as a little reddish spot for several years, when, its activity being aroused, how or why, we know not, it grows with unwonted vigor, and soon attains a large bulk. The tumor has generally an irregular outline, and rarely projects more than six or eight lines beyond the level of the surrounding parts. It is soft and compressible, the finger sinking into it as it would into a wet sponge, but the moment the pressure is removed it immediately regains its former situation. Its color varies in different cases; when it occurs in the skin, or skin and cellular tissue, it is generally of a reddish hue, inclining to scarlet, especially in its earlier stages; but in old cases, and when it lies beneath mucous membrane, it is more commonly of a bluish or purplish color. It beats and throbs synchronously with the contraction of the left ventricle of the heart, and imparts a peculiar aneurismal thrill to the finger. Its movements are often perceptible at a considerable distance, and are always sensibly augmented under the influence of mental emotion. When of considerable volume, the tumor may produce severe pain and other inconvenience by its pressure, but in most cases there are but little local suffering and constitutional disorder.

Such a tumor sometimes ulcerates and sloughs, causing more or less hemorrhage, and ultimately perhaps death. Some years ago, I saw a female child, aged ten months, who had a congenital arterial nevus upon the right shoulder and arm, which gradually extended down towards the elbow; it was of a dark purple color, and of a soft, spongy consistence, throbbing and beating violently. The general health was good, but after some time ulcers began to form on different parts of the tumor, which now became very painful and inflamed; in a few weeks more gangrene set in, and, gradually progressing, soon destroyed the little patient. The hemorrhage which succeeds the ulceration of this tumor, although sometimes very profuse, seldom proves fatal; after the bleeding has continued for some time, the blood coagulates upon the abraded surface, and thus affords the vessels an opportunity of preventing further effusion. In the female, the hemorrhage is occasionally vicarious of the menstrual flux; the tumor becomes full and tense at the return of each period, and, giving way at the top, allows the blood to drain off, without serious injury to the part or system. It has been asserted that such a growth may degenerate, changing its primitive character, and assuming one of a

worse kind, as the medullary or melanotic. Without altogether denying the possibility of such an occurrence, I have never seen any cases in my own practice to justify the conclusion.

The treatment of this form of tumor may be conducted by excision, escharotics, strangulation, injections, starvation, and, lastly, by amputation, as when the disease occupies one of the extremities. Besides these methods, there are several others of a more doubtful and less trustworthy character, which will be briefly noticed in their proper place.

a. Excision is chiefly adapted to small arterial tumors, before they have acquired much functional activity, or given rise to any marked enlargement of the neighboring arteries. The operation is then perfectly safe, easy of execution, and likely to be entirely successful. But if we wait until the tumor has attained a large bulk, beating and throbbing violently at every pulsation of the heart, as if it were ready to burst, the attempt, besides proving one of immense difficulty, may be attended with so copious a hemorrhage as to cause speedy exhaustion; we have then a formidable enemy to deal with, and we may consider ourselves happy if we do not let our patient perish from the loss of blood, gushing forth, as it will, in torrents, at every stroke of the knife. In such a case the prudent surgeon weighs well, before he begins his perilous operation, the chances of his success; he measures every inch of the unexplored territory, and equips himself thoroughly, at every point, for the trials and perplexities of his portentous undertaking.

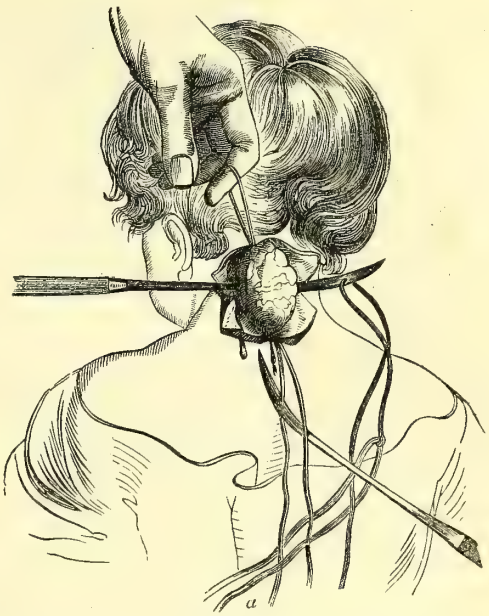
When excision is determined upon, the rule of practice is, as John Bell long ago so correctly observed, not to cut into the tumor, but around it, and yet not so widely around it as to include an unnecessary quantity of sound tissue. The operation is performed rapidly, the finger of a good assistant quickly following the knife in order to compress any important artery that may be divided, until the whole mass is completely extirpated; and it will be wise, if practicable, always to arrest the circulation in the main artery leading to the tumor before we begin our incisions. Removal being effected, upon the principle here enjoined, the ligature may often be entirely dispensed with, all bleeding ceasing the moment the operation is over; or as soon as the edges of the wound are thoroughly approximated by the twisted suture, a mode of dressing peculiarly adapted to this form of disease, on account of the hemostatic influence exerted by its compression.

b. Small arterial tumors may often be readily destroyed by *escharotics*, of which I have found the Vienna paste to be preferable to any other, used as in making an ordinary issue. The paste is retained for fifteen minutes, being spread out sufficiently to cover the whole of the affected surface; the application is followed up by an emollient poultice, and when the slough is detached the sore is treated upon general principles. When the tumor is very large, and so situated as not to involve any important structures, interference with which might prove prejudicial, it may be attacked, either simultaneously or successively, at several points of its extent, for the purpose of converting the whole mass into an eschar. For obvious reasons the

caustic should not be used upon those parts of the body which are habitually exposed, as the face and neck.

c. Strangulation may be effected by transfixing the base of the tumor with one or more needles, and then drawing a ligature firmly around them, so as to cut off at once, and effectually, its sanguineous supply. Or, instead of this, a stout double thread may be conveyed beneath and around it by means of a spear-pointed needle, provided with an eye, one cord being tied upon one side of the swelling, and the other upon the opposite side. If the integument be sound, the ligation is preceded by its careful division and reflection, as in fig. 221, in order that, when the morbid growth has been removed, it may be replaced, and thus serve to protect the parts from an unseemly cicatrice.

Fig. 221.



Erectile tumor. The integument uninvolved, has been reflected by flaps. Transfixion is being completed, previous to deligation. *a*. The larger ligature, in the act of being pulled through. It fills the aperture of puncture, preventing bleeding; and, besides, bears a stronger strain in the tying.

d. Starvation may be attempted in one of two ways; either by tying the arteries which immediately feed the tumor, or else by occluding the main vessels which lead to the parts where the tumor is located. Of these two methods, preference should always, if possible, be given to the former, on account of its having a more direct and controlling influence upon the arrest of the morbid growth; when the swelling is very large, the two plans may sometimes be advantageously combined. Ligation of the arteries in the immediate vicinity of the tumor should be performed at several points at once, otherwise but little impression will be likely to follow; and care is taken, in performing the operation, not to interfere with the proper substance of the tumor, lest embarrassing hemorrhage ensue.

Deligation of the main artery leading to the parts upon which the morbid growth is situated has hitherto been practised chiefly upon the common carotid, in aneurism by anastomosis of the orbit, face, and scalp. The success has been variable, but, in the main, not very flattering, and yet I conceive that the procedure may be very proper when no other treatment is available. The misfortune, perhaps, is, that it is always employed as a dernier resort, and it is, therefore, not

surprising that it should have so often failed. Dr. Mott, many years ago, tied the common carotid artery on account of a large arterial tumor, involving both orbits, the nose, and part of the forehead, in a child only three months old; the mass gradually diminished in size, and became so much consolidated as to lead to the belief that it might afterwards be extirpated, if such a measure should be deemed expedient. The final result of the case has not been reported. In 1828, I assisted Dr. George McClellan in taking up the right common carotid for the cure of an aneurism of the corresponding side of the face and orbit, in a child five months old. The operation seemed to arrest the growth of the tumor for a fortnight, but, at the end of that time, its activity was again aroused, and it went on gradually and steadily increasing until it caused death by hemorrhage and constitutional irritation. Dr. Mussey, Dr. J. Mason Warren, and others, both of this country and of Europe, have tied both carotids for the cure of this disease. The first of these surgeons applied the second ligature, after an interval of twelve days, without the occurrence of any untoward symptoms. In the case of Dr. Warren, a little upwards of a month elapsed between the first and second operations; no unpleasant effects supervened, and the patient, a man, aged twenty-three years, made a rapid recovery, although the arterial tumor was of enormous size, involving the mouth, face, and neck. Professor Kuhl, of Leipsic, tied the left carotid in a man of fifty-three, and, in forty-one days afterwards, the right carotid, on account of an extensive arterial disease of the scalp. The patient recovered, but not without considerable cerebral disturbance and repeated hemorrhages from the tumor. In tying two such large arteries for the cure of this affection, it is important to allow a sufficient period to intervene between the two operations for the dilatation of the collateral vessels which supply the brain, so as to enable this organ to obtain the requisite supply of blood for the proper execution of its functions. Several cases, it is true, have lately been published, in which the ligation was performed after a very brief interval, without any serious detriment to the cerebral circulation, yet this fact does not invalidate the necessity of this precaution in the class of maladies in question.

e. Of the various *injections* that have been used for the relief of this tumor, the principal are nitric acid, creasote, iodine, and perchloride of iron, introduced in small quantity, either pure or diluted, with a delicate syringe, similar to that spoken of under the head of aneurism. These fluids are all more or less irritating, while several of them are capable of exciting high inflammation; hence it is hardly necessary to add that they should be employed with the greatest possible care and gentleness. At least one case is upon record, where a drop of nitric acid, injected into a small arterial growth of a child, caused death by convulsions.

The only really unobjectionable injection, for the cure of this disease, is a strong solution of persulphate of iron, a few drops of which may be deposited in different parts of the tumor, by means of a delicate syringe, the nozzle of which, introduced subcutaneously, is moved about in such a manner as to break up the coats of some of the capil-

lary vessels. Coagulation occurs almost instantaneously, and in the course of from five to ten days, the whole growth drops off in the form of a slough, leaving a sore which gradually heals by granulation. By means of this salt, which is now rapidly coming into use as a hemostatic, I am satisfied that any case of arterial or venous tumor, unless very bulky, may be promptly and effectually cured.

f. Finally, among the subordinate and less certain remedies may be mentioned the use of heated needles, the seton, vaccination, and compression.

The introduction of *heated needles* into the midst of the morbid growth was strongly recommended, some years ago, by several American surgeons, who followed up the suggestion by the publication of a number of cases illustrative of its efficacy. On the strength of these reports, I was induced to make trial of the remedy in a number of instances which fell into my hands shortly afterwards, but such was my disappointment that I soon abandoned it altogether. My opinion is that few practitioners now employ it, or have any particular confidence in its efficacy. In performing the operation, which is adapted only to very small arterial tumors, a number of slender, sharp-pointed needles, generally as many as three, four, or five, inserted into a wooden handle, and heated red, are thrust into different parts of the morbid growth, where they are retained until they become cool, when they are withdrawn, the introduction being repeated every three or four days, the object being to provoke an effusion of plasma. Besides the pain attending this procedure, such is its uncertainty, that it is questionable whether it deserves a place among the regular and accredited remedies for the cure of this disease.

A few cases of cure of the arterial tumor by *vaccination* have been reported. The remedy is, of course, applicable only to persons whose system has not been previously protected by this operation; and it is necessary, in order to be successful, that the virus should be inserted at different points, so that the effects of the resulting inflammation shall be deeply felt by the whole growth. The operation is sometimes followed by violent inflammation and high constitutional disturbance, threatening convulsions, and other serious accidents.

The *seton* is, perhaps, on the whole, more reliable than any other of these subordinate remedies; introduced underneath the tumor, and left there till suppuration is fully established. If the growth be small, a single thread may suffice, otherwise three or four may be necessary, or, perhaps, even a larger number. A small needle, inserted into a handle, is used, the cord being dragged through so as to fill the puncture made by the instrument, thereby preventing hemorrhage. I have treated three cases of small arterial tumors on the scalp successfully by this method.

Compression is sometimes employed, generally through the medium of the pad of a truss, or of a piece of ivory, coin, or sheet lead, confined by adhesive strips and a roller. To prove efficient, it must be made in a steady, uniform manner, the cases to which it is chiefly adapted being those in which the tumor is diminutive, and situated upon a hard, bony surface. The procedure is exceedingly unsatisfactory.

g. When the tumor is irremediable by the various measures now described, and is so situated as to admit of it, *amputation* may become necessary. Much as such a step is to be regretted, no one, I conceive, should hesitate to take it when the disease occupies a finger, hand, arm, foot, leg, or thigh.

SECT. II.—VENOUS TUMORS.

Under this head may be described a morbid growth, composed chiefly of dilated and varicose veins, held together by connective tissue; situated, for the most part, upon the scalp, cheek, lip, and chin, but also liable to occur in other regions, as the trunk and extremities. The submucous cellular substance of the mouth, tongue, and vulva may, likewise, be mentioned as occasional seats of the disease, and there is one form of hemorrhoidal tumor which evidently closely assimilates itself to it in structure. Varying in size and prominence, it may, originally, not be larger than a small pimple, which, gradually spreading in different directions, may ultimately acquire an extraordinary bulk, forming a considerable projection, and occupying a diameter many inches in extent. Its color is usually purple, or claret, either continuously, or intermixed with various shades of red; occasionally it is dark-mottled, especially when the enlarged veins lie nearer the surface at one point than at another, thus rendering their contents distinctly visible through the attenuated integument. In its consistence it is soft and spongy, diminishing sensibly under pressure, but speedily regaining its former bulk when the pressure is removed. It is free from pulsation, bruit, and expansion, and is comparatively little influenced by mental emotion. Sometimes the growth is tardy, at other times rapid; it is usually congenital, but may occur at any period of life, sometimes, and most generally, without any assignable cause, and at other times as a consequence of external injury. At first there is commonly no cutaneous involvement, the tumor being strictly limited to the cellular tissue; by and by, however, the skin becomes uniformly attenuated, or thickened at one spot, and atrophied at another, and thoroughly incorporated with the morbid structure. As the disease advances, but generally not until it has attained considerable bulk, ulceration may take place, followed by smart hemorrhage, chiefly of a venous character, and easily checked by pressure.

The venous tumor consists of a network of dilated capillaries, not of new development, but simply an exaggeration of those which are peculiar to the part where the morbid growth is situated. They are connected together by loose cellular tissue, are more or less tortuous in their disposition, and have exceedingly thin, delicate walls, so that, when a body of this kind is excised, they immediately collapse, the structure, which previously formed a large mass, shrinking away into a little, spongy remnant. In the specimens which I have had an opportunity of examining, no abnormal vascular cells or fibrous bands were distinguishable; and, as the operations performed for their removal were almost bloodless, it is evident that the arteries which

entered into their composition must have been exceedingly small and few in number. In very old and large growths of this kind, some of the individual veins are occasionally of enormous size, as well as remarkably tortuous, and contain fibrinous and earthy concretions, lodged in separate compartments. Such occurrences are most frequently met with in venous tumors on the trunk and buttocks.

The venous tumor is most easily dealt with by excision, and, unless the growth be of inordinate volume, such a procedure will be almost bloodless. The annexed sketch, fig. 222, represents a large tumor of this kind, which I removed from the left side of the face and lip of a young lady of twenty-four, with the loss of hardly three ounces of blood, although the operation necessarily involved the division of the coronary artery. The tumor had commenced early in life, and had greatly disfigured an otherwise very pretty face. During the excision, it literally shrunk away to nothing. Fig. 223 shows the result of the

Fig. 222.

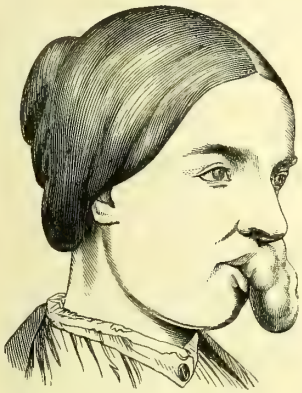


Fig. 223.



operation. Should any considerable artery be embraced in the general mass, it must, of course, be secured, either during the dissection, or immediately after the extirpation has been completed. The same rule of cutting round the tumor, and not into it, should be observed here as in the removal of arterial growths.

When the knife is objectionable, a venous tumor, if small, may readily be destroyed by the subcutaneous injection of a few drops of a strong solution of persulphate of iron. The procedure is perfectly safe, and productive of but little suffering. I have performed the operation in several cases with very gratifying results. The diseased tissues usually slough off in from five to eight days. Such growths may also be readily destroyed by strangulation, either with the ligature alone, or with the ligature and needle, in the form of the twisted suture; if very large, however, they must not be meddled with in this way, otherwise, violent inflammation arising, the operation may prove fatal.

CHAPTER VIII.

DISEASES AND INJURIES OF THE JOINTS.

SECT. I.—WOUNDS.

THE joints are liable to be laid open in various ways—by cuts, stabs, punctures, balls, machinery, and other means—and hence such lesions are said to be incised, punctured, gunshot, or contused and lacerated, according to the nature of the vulnerating body. In extent they may be small or large; in character, simple or complicated; in effect, trivial or severe.

The symptoms are generally sufficiently distinct. When any of the large joints have been opened, in whatever manner, whether by a cut, laceration, or bullet, the nature of the accident is generally denoted by an immediate escape of synovial fluid, rapidly followed by great pain, tension, and swelling of the part, with severe constitutional disturbance. When the wound is very large, especially if it be of a gunshot nature, there will generally be, along with the symptoms just mentioned, violent shock, the patient being deadly pale, faint, and sick at the stomach; and some hours may elapse before reaction comes on. In from twelve to twenty-four hours after the accident, fever commonly sets in, often preceded by rigors, and soon followed by delirium, great gastric distress, intense thirst, and excessive restlessness, with a strong, full, and bounding pulse. The local phenomena assume a more aggravated character. The heat, pain, redness, and swelling increase in intensity, and the surface of the limb, at the seat of the injury, often assumes an erysipelatous aspect, sometimes as early as the first thirty-six hours after the accident, and seldom later than the third or fourth day. Meanwhile, the discharge of synovial fluid augments in quantity, as well as in consistence, exhibiting a thick, ropy, turbid appearance; or, if the wound be closed, and the fluid is retained, the joint becomes distended in every direction, but particularly in its more dilatable parts, the integuments pit on pressure, and distinct fluctuation is perceived. The secretion now takes on a puriform character; the patient has frequent rigors, alternating with flushes of heat, and succeeded by copious sweats; the joint is exceedingly tense; the synovial membrane is universally involved; perforative ulcers form at different points; matter is freely discharged, often of a highly fetid nature; the bones are rendered carious; and the ligaments, softened and thickened, yield at various points of their extent. In some cases matter forms exterior to the joint, and is extensively

diffused among the muscles and through the subcutaneous cellular tissue.

But it is not always that matters progress in this wise. The case which I have described is an extreme one. In many instances, depending mainly upon the nature and extent of the lesion, and the character of the treatment, the inflammation, after having persisted for a few days, gradually disappears, and the patient recovers with hardly an untoward symptom, the joint, it is true, remaining temporarily stiff, but ultimately completely regaining its functions.

It cannot, however, be disguised, that all wounds of the joints, however trivial or insignificant they may apparently be, are in reality fraught with danger, if not soon after their occurrence, at a period more or less remote. Gunshot and lacerated wounds in particular are hazardous, and are not unfrequently followed by fatal consequences. I have seen, however, what, indeed, all men of experience must occasionally witness, some very extraordinary cases of recovery after injuries of this description. Thus, I attended, many years ago, a lad of fourteen, who, while bathing, struck his knee against the sharp point of a rock, causing a severe penetrating wound, which got well without any serious local or constitutional symptoms, although it was in all respects, at first, most unpromising. In another case the knee-joint was opened by a pistol ball, entering by the side of the patella, and apparently lodging in one of the condyles of the femur, with no other effect than that of a moderate synovitis, and slight lameness.

Simple incised wounds are to be less dreaded, as a general rule, than lacerated and gunshot, although undoubtedly many cases occur where the symptoms are extremely severe, and where the risk to limb and life is very great. It may also be assumed that a wound of a small joint is less dangerous than a similar injury of a large joint, an incised than a lacerated one, a small wound than a large one, and a simple than a complicated one; the lesions, in these respects, being governed by the same laws as wounds in other parts of the body. There are several circumstances, however, which render wounds of the joints, especially of the more important ones, as those of the knee, ankle, and elbow, peculiarly perilous, and which are the more to be dreaded because they are of frequent occurrence. These are erysipelas, pyemia, and tetanus.

Erysipelas, as a consequence of articular wounds, usually sets in within the first thirty-six hours, beginning at the site of injury, and spreading thence gradually over the neighboring surface. Its precise type will depend materially upon the state of the system at the time of the accident; its symptoms exhibit nothing peculiar, but its progress is often very rapid, and its presence is always denotive of a bad state of the constitution, which it is frequently difficult to counteract by remedies.

Pyemia is a frequent result of wounds of the larger joints, especially when of a lacerated, contused, or gunshot nature. Abscess of the internal organs, as a consequence of such lesions, was occasionally noticed by some of the older surgeons. The viscera which are most liable to suffer are the lungs, liver, spleen, and kidneys, the disease

usually appearing within the first five or six days, and speedily undermining the constitution. As a concomitant of this occurrence important changes take place in the local symptoms. The pain becomes extremely intense, the swelling rapidly increases, and the wound discharges an abundant fluid, of a thin, sanious, and highly fetid character, denotive of the bad nature of the inflammation. The general phenomena are typhoid, the patient is delirious, and death soon closes the scene.

Tetanus is an occasional occurrence after injuries of this kind, but not as frequently, perhaps, as is generally supposed. I have seen only a few cases of it. The last which I had under my charge was a young man, of twenty-four, who received a large wound in his knee, involving the patella, from a fall of his horse, the animal rolling upon his leg. For some days he was progressing favorably, when delirium tremens and tetanus set in, and he died shortly afterwards. Such an occurrence must be much more common in military than in civil practice.

The *hemorrhage* which follows wounds of the joints, although generally trivial, is occasionally quite profuse, not always so much from lesion of the articular vessels themselves as from injury of those in the immediate vicinity. When the blood accumulates in the cavity of the articulation, whether from internal effusion, or in consequence of outward introduction, it may act as an extraneous substance, undergoing decomposition, and thus greatly aggravating the case.

Treatment.—The treatment of these wounds is sufficiently simple, inasmuch as it involves no principles different from those which guide us in the management of similar lesions in other regions of the body. It consists, mainly, in approximating the edges of the incision, removing extraneous matter, excluding the admission of air, forbidding all motion of the joint, and employing antiphlogistics to their fullest extent.

When the wound is simply an incised one, a few strips of adhesive plaster will generally suffice to effect approximation, and the risk of admitting air will be greatly diminished, if the part be covered with a compress wet with blood, and bound down by a roller, extending from the distal portion of the limb upwards. The practice, however, which I generally follow in such a case, is to bring the lips of the wound together with collodion, applied with great care, so that there shall not be the least possible risk of the admission of the atmosphere, which, although in itself perfectly innocuous, is extremely liable to prove prejudicial by causing rapid decomposition of the inflammatory products. Hence, too much caution cannot be observed in the application of our dressings. If the wound be large, a few sutures may be necessary; but in general they may be dispensed with altogether. Should their aid be required, care must be taken to carry them merely through the common integuments, and when so used, they will, I am satisfied, notwithstanding what has been said to the contrary, be just as innocent here as in any other parts of the body. In lacerated wounds, it will generally be advantageous to pare the edges before

approximating them, as this will place them in a better condition for immediate reunion.

When the wound is large, the synovial membrane may be covered with extraneous matter, as dirt, sand, or other substance, which may not only prove difficult of removal, but will be sure to enhance the danger of erysipelas, pyemia, and tetanus. Clearance must be thorough, and the finger and forceps will be the best instruments for effecting it. Any clotted blood that may exist must be dealt with in a similar manner. If the foreign matter be deeply imbedded in the joint, and the wound is disproportionably small, rendering a search for it difficult and uncertain, the safest plan will be to let it alone. Balls ought certainly always to be treated in this manner. If, on the contrary, the projectile lie loose in the articulation, it should unquestionably be extracted at once, and so with every other movable or floating body, provided it is readily accessible, or that it can be taken away without the risk of inflicting serious additional injury. All officious interference, by finger, probe, or other instruments must be scrupulously avoided, as the synovial membrane is eminently intolerant and resentful of manipulation, however gently conducted, bearing, in this respect, the greatest possible resemblance to the peritoneum, which, as every one knows, can hardly be touched without becoming inflamed.

When there is no prospect of union by the first intention, or when the condition of the wounded joint is such as to render suppuration inevitable, the proper course to be pursued is to draw the edges of the wound lightly together with adhesive strips, and to resort, without delay, to medicated applications, either in the form of water-dressing, or of emollient cataplasms. To do otherwise would only enhance the danger of inflammation and of other bad consequences, without any compensating advantages.

Whatever dressings be employed, it is of paramount importance to keep the joint in an elevated and quiet position, all motion being guarded against by the use of splints and other suitable means. If the inflammation run high, liberal use must be made of leeches, scattered over the affected surface, and applied in such numbers and with such frequency as the particular exigencies of the case may seem to require. If the patient be young and plethoric, blood is promptly taken from the arm, the bowels are thoroughly moved, and the saline and antimonial mixture is freely employed, a few drops of tincture of aconite being conjoined with each dose, in order to lessen more effectually the heart's action. Opium, or its salts, in large doses, will be required to relieve pain and spasm; and there is hardly a case, certainly none of severe articular wound, where it will not be proper to combine calomel with the anodyne, with a view to its speedy effects upon the system. The acknowledged efficacy of mercury in all inflammations of the serous textures, clearly points to its administration as a matter of paramount importance here. It not only exerts a most happy influence upon the capillary vessels of the diseased membrane, modifying and changing their action, but it is a powerful sorbefacient, and thus proves beneficial in the removal of effused fluids. Its effects, however,

must be carefully watched, lest they exceed our intention, which is only to cause tenderness of the gums, and not positive ptyalism.

During the progress of the case, matter may form within the joint, and become pent up for the want of an adequate outlet. Under such circumstances, relief must be afforded by a valve-like aperture, the puncture being immediately closed by collodion, and afterwards re-opened as occasion may seem to demand. When the quantity of pus is very great, pressing upon the joint in every direction, a free, direct incision should be made, to admit of full drainage. It has always appeared to me that surgeons are too timid in these cases, and that they do not sufficiently co-operate with nature in her efforts to effect a cure. It can assuredly not be necessary here to describe the pernicious consequences which purulent accumulations, especially if long retained, must inevitably exert upon the component elements of the articulation. They can be nothing short of utter ruin of the synovial membrane, cartilage, and bone. Early evacuation must also be effected, if matter form immediately around the joint, beneath the integuments and among the muscles.

When the discharge is profuse and offensive, injections of linseed tea, slightly medicated with the chlorides, will be of service; they should be thrown in tepid, several times in the twenty-four hours, and may sometimes be advantageously followed by the introduction of very weak solutions of iodine, or nitrate of silver, with a view of modifying the action of the synovial membrane. Too much caution, however, cannot be used in the application of these remedies, as the inflamed membrane is often exquisitely sensitive, and intolerant of such contact.

Whenever there is extensive suppuration, the parts will either recover by union of their contiguous surfaces, or the cartilage and bone will perish, or, at all events, become so involved in disease as to require removal. In the former case, the joint should be placed in the best position for future convenience and usefulness; while in the latter the affected structures should either be excised, or the limb be amputated. The choice of the proceeding must be regulated by circumstances. If the inflammation has measurably subsided, and the patient's strength is not too much exhausted, the joint may possibly bear excision; but in all cases of an opposite character the removal of the limb will, I am convinced, be the safer operation.

In the milder forms of wounds, where there is no risk either of limb or life, the great point of interest is to guard against anchylosis, which is so liable to occur even in the most trivial affections of the articulations. Passive motion, sorbefacient embrocations, and the gradual use of the limb, will be the surest means of preventing this.

Primary amputation will be required when the joint is severely shattered, whether by gunshot or otherwise, and the external opening is unusually large, or complicated with lesion of the principal vessels and nerves of the limb. As a general rule, it may be assumed that gunshot wounds of the large articulations of the extremities are nearly always followed by fatal consequences, if amputation be not speedily employed. The same may be said, though in a more limited sense, of

gunshot injuries of the joints of the toes and fingers, in which tetanus and other bad effects are prone to ensue. In the subjoined case, where an attempt was made to save the limb, life was lost by locked-jaw. Amputation, I am satisfied, ought to have been performed on the spot.

John E. Wilson, aged twenty-four, of stout, muscular frame, but intemperate habits, was thrown, while intoxicated, from his horse, the animal falling upon him, and inflicting a frightful wound upon the right knee, penetrating the joint. The patella was broken into several pieces, and a considerable quantity of dirt and gravel lay in the gap, a good deal being also imbedded in the muscles and cellular tissue. Amputation being strenuously objected to, the wound was cleared of foreign matter, and united by suture and adhesive strips, supported by a roller extended from the toes upwards. The limb was placed in an easy, elevated position upon an inclined plane, and the joint was kept constantly wet with cold water-dressing. A grain of morphia was immediately given to allay pain, which was very severe.

The case, under the judicious management of Dr. Metcalf, went on kindly until the third day, when erysipelas set in, accompanied with delirium tremens, which were treated in the usual manner. The man remained in this condition for nearly a week, alternately better and worse, as far as his general symptoms were concerned, but doing well as it respected the limb. At the end of this period a decided improvement became manifest, lasting, however, only for about twenty-four hours, when tetanus supervened, causing death a few days afterwards.

SECT. II.—SPRAINS.

A sprain is the wrenching of a joint in which its ligaments are severely stretched, if not partially torn, and more or less injury is done to the parts around. Falls, blows, and twists, attended with rotation of the articulating surfaces, or a movement of these surfaces in opposite directions, are the most common causes of the accident.

The joints which are most obnoxious to sprains are the ginglymoid, or those which admit of motion principally in two directions, as the knee, ankle, and elbow. The articulations of the toes, thumb, and fingers frequently suffer for the same reason, their functions and exposed situation rendering them especially prone to such accidents. The reason why the orbicular joints are so seldom affected in this way is their greater latitude and freedom of motion, their surfaces being thus enabled to undergo extensive rotation without putting their ligaments or the surrounding parts materially upon the stretch, whereas in the hinge-like joints the most trivial twist, by opposing a sudden check to their extremities, must necessarily cause a severe wrench. Moreover, it must not be forgotten that there is an essential difference in the structure of the ligaments themselves in the two classes of joints, which cannot fail to exert a powerful influence upon the production of the accident in question. In the orbicular joints the connecting media are of a fibrous texture, comparatively thin, yielding, and extensible and therefore able, to a considerable extent, to get out of the way of

injury; in the ginglymoid, on the contrary, the ligaments are exceedingly firm, short, and indisposed to stretch, or, when stretched, incapable of withstanding rupture, either partial or complete, of their fibres. The orbicular joints are, however, notwithstanding their greater latitude of motion and the more yielding nature of their ligaments, occasionally severely sprained in consequence of the extreme abduction of the limbs. Thus the ileo-femoral articulation is sometimes violently sprained by the sudden slipping of the foot outwards, far beyond the line of the body, so as to put both the capsular and round ligaments strongly upon the stretch, inducing symptoms extremely simulative of dislocation of the head of the bone into the thyroid notch.

It is probable that there is, in every case of severe sprain, more or less injury inflicted upon the parts in immediate relation with the affected joint. The muscles and tendons must necessarily participate in the wrench, suffering partial displacement, and sometimes even slight laceration; the nerves and vessels are stretched; and the integuments are often bruised and discolored, especially when the accident has been the result of external violence. In the latter case, the articulating surfaces, being violently brought together, not only experience a severe shock, but sustain a considerable degree of contusion, thus greatly aggravating the case.

Symptoms.—The symptoms denotive of sprain are the instantaneous occurrence of pain, referred to the affected joint, impairment or total loss of motion, and a sense of faintness or sickness, caused by the shock of the system, which is sometimes extremely severe, even when no external injury has been sustained, the accident having been induced merely by a wrench or twist of the limb. If some time has elapsed since the accident, there will be swelling and tenderness of the integuments, as well as of the deeper structures, and probably also an indistinct perception of crepitation, depending upon the deposit of plastic matter. Discoloration of the surface, from extravasation of blood, is also a not uncommon phenomenon. The pain is often at first excessive, and quite overpowering in its effects upon the system.

The only accident with which a sprain is liable to be *confounded* is dislocation; but from this it may generally be readily distinguished by a careful manual examination, by the form of the joint, by a comparison of the length of the affected limb with that of the sound one, by the history of the cause of the lesion, and, lastly, by the fact that the patient is usually able to use the parts, at least to some extent, immediately after the receipt of the injury. The examination should always be most thorough, lest a luxation be ultimately found, and that, perhaps, when too late to effect reduction, where originally only a sprain was suspected.

When the sprain is slight, the pain gradually subsides, the swelling is resolved, and the joint soon regains its accustomed functions. It is far otherwise, however, when the injury is of an opposite character or attended with severe wrenching of the ligaments, violent contusion of the articular surfaces, and considerable lesion of the surrounding parts. Under such circumstances, the suffering will be proportionably great, inflammation will be apt to run high, convalescence will be tedious,

and the joint may remain weak and tender for many months, or even several years. A severe sprain, in fact, is often a much more serious accident, as it respects its secondary effects, than a dislocation or a fracture near a joint. In neglected or ill-treated cases, and sometimes even when every possible precaution has been adopted, it will be found that the articulation not only continues to be weak and uncomfortable for a long time, but that the corresponding limb becomes cold, wasted, flabby, and exquisitely sensitive; perhaps also the seat of neuralgic pain, subject to severe exacerbation whenever exercise is attempted, or there is a change in the weather. Occasionally, indeed, the movements of the joint are never regained. Conjoined with this local trouble there is generally grave disorder of the general health, the patient being extremely nervous, irritable, and dyspeptic, fancying himself helpless and disqualified for all useful exertion, both of mind and body. The probable cause of all this suffering is the shock or concussion sustained by the nerves of the affected joint at the moment of the accident, the effect thus produced exercising a pernicious influence upon the nutritive functions of the whole limb, and indirectly upon the well-being of the general system, especially the great nervous and ganglionic centres.

Treatment.—Two leading indications present themselves in every case of sprain, whether slight or severe; the first is to limit and combat inflammation, and the second to restore the joint, if possible, to its wonted functions. The first is fulfilled by the judicious use of antiphlogistics; the second, by sorbefacients, passive motion, and exercise in the open air.

As soon as the joint has been subjected to the requisite examination for determining the diagnosis, the limb connected with it is to be carefully bandaged, and placed perfectly at rest in an easy, elevated position, splints, a tin case, or a wooden box being used, if necessary, to insure more certain quietude. Sometimes the object is readily attained by laying the limb simply upon a pillow, though in warm weather this will be objectionable, as tending to keep up too much heat. Fomentations will usually be found to be more agreeable and soothing than cold applications, especially during the first few days, in nervous, irritable subjects; and the one which I generally prefer to any other is a strong solution of acetate of lead and opium in hot water, applied by means of a piece of flannel, arranged in four, six, or eight thicknesses, and covered with a piece of oiled silk, to confine the heat and moisture. Instead of removing the cloth whenever it becomes dry, the best plan is to squeeze the lotion upon it, as occasion may require, from a sponge, as this will obviate injurious motion and exposure to the atmosphere. Solutions of hydrochlorate of ammonia and opium, a mixture of warm water, laudanum, and alcohol, and thin bags of hops will also be found extremely soothing. In sprains of the ankle-joint, I have frequently seen the happiest effects produced by protracted immersion of the limb in hot salt water. When the pain and swelling are unusually severe, leeches will be necessary, and should be employed in numbers suited to the age and strength of the patient, and other exigencies of the case. Anodynes

will usually be required to allay muscular spasm, and should be given in liberal doses, either alone or in union with diaphoretics. Purgatives must not be neglected, and if there be any constitutional excitement, the saline and antimonial mixture will come in play. In short, the whole antiphlogistic system must be carried out in its full extent.

When warm applications prove disagreeable, or are unproductive of relief, cold should be substituted in their place, consisting either simply of water or of some refrigerating mixture. The proper rule is, in all cases, to continue no remedy longer than it is found to be soothing and beneficial.

The bandage must be carefully watched; judiciously employed, its effects are usually highly advantageous, affording support to the injured joint and limb, preventing swelling and spasm, and promoting the absorption of effused fluids.

In the milder forms of sprains, more simple means will of course answer, such, for instance, as applications of the tincture of arnica, laudanum, or laudanum and spirits of camphor, aided by perfect quietude of the affected parts.

The urgent inflammatory symptoms having thus been subdued, embrocations, liniments, or lotions will be of use, the object now being the removal of effused fluids and the gradual restoration of the functions of the joint. These should be applied at first once, and afterwards twice a day with the bare hand, the friction being gradually increased as the pain and tenderness diminish, and it will be well generally to keep the parts constantly wet with the medicine by means of a piece of flannel. Whatever local remedies be used, the bandage must on no account be neglected; for, beneficial as it may have been in the first instance, its effects will now be incomparably more so. The limb, weakened by the previous suffering, requires tone and support, and there is nothing so well calculated to afford these as the careful and judicious employment of the roller. It should be renewed at least once a day.

At a still later stage of the treatment, great benefit will accrue from the cold douche, the water being pumped upon the part, or poured upon it from a considerable height, and the surface well rubbed afterwards with the bare hand, or a piece of coarse flannel. In some cases, where a more powerful impression is necessary, it will be found highly advantageous to use the hot and cold douche, in immediate succession. Along with these means the use of the bandage is still steadily continued, and it may even be necessary to persist in the employment of stimulating embrocations. In some of these obstinate cases I have derived marked benefit from the daily application of fish-brine, which seems to possess other properties than those simply dependent upon the presence of saline matter, though it is impossible to define their character. Occasionally a blister affords more relief than any other remedy, and now and then electricity is advantageous.

Finally, as soon as the disease has reached the chronic stage, the joint must be gently exercised, and the patient made to walk about upon crutches in the open air. As great care should always be taken, in the acute stage, not to move the parts too soon, so in this we must

not too long delay its employment. Motion is the proper stimulus of a joint, as air is of the lungs, or food of the stomach, and when, after any injury, it is long neglected, serious consequences will be sure to arise. By and by the crutch must be laid aside for the cane, and this in turn for the limb, the joint and muscles being gradually compelled into action. In nervous, hysterical persons this will often be a sore trial, requiring no ordinary effort of the will; nevertheless, it must be done; there is no alternative; the parts must be used, or they will inevitably remain stiff and tender, and ultimately become worthless.

When there is much constitutional suffering, as there often is in the more severe forms of sprains, alteratives and tonics will be needful, and the best of these will be found to be blue mass, quinine, iron, iodide of potassium, and bichloride of mercury. Exercise in the open air must not be neglected.

SECT. III.—SYNOVITIS.

Inflammation of the joints, technically called synovitis, is liable to occur in all articulations, but more especially in such as are of large size, and of great importance as it respects their functional activity; it may be induced by various causes, both local and constitutional, as exposure to cold, the presence of interarticular bodies, and mechanical violence, as sprains, blows, falls, and contusions. In the great majority of cases, however, it arises from the effects of rheumatism, gout, eruptive fevers, the inordinate use of mercury, syphilis, and scrofula.

Symptoms.—The symptoms characterizing inflammation of a synovial membrane may be stated, in general terms, to be stiffness of the corresponding joint, which is usually greatest in the morning immediately after rising, but gradually diminishes upon exercise; pain and tenderness on moving and percussing the limb; swelling and fluctuation of the affected part; a pale, glossy appearance of the skin; inability of maintaining the extended position; and a sense of heat within the articulation. As the malady progresses the symptoms increase in severity, and the system, sympathizing with the local disorder, is thrown into violent commotion, there being high fever, a full, bounding pulse, and an arid skin, with excessive thirst and all the other phenomena of inflammatory excitement. Under such circumstances the pain is generally very excruciating, especially at some particular spot, depriving the patient completely of appetite and sleep, and requiring large doses of opiates for its subjugation.

The disease, however induced, frequently comes on in a slow, gradual, and insidious manner, even when caused by external injury, being characterized, perhaps, merely by a trifling enlargement of the joint, arising from an increase of synovial fluid within its cavity, or partly from this and partly from inflammatory deposits in the surrounding structures, attended with some degree of tenderness on pressure, and more or less suffering on motion of the affected parts. Eventually, however, yet it may be not under several weeks, or even months, the

joint assumes a soft and really swollen appearance, the limb becomes wasted, the functions of the articulation are materially impaired, and all the symptoms are aggravated.

In *rheumatic* synovitis the symptoms are usually bold and well-marked from the start. The attack often comes on this way: The patient, having been exposed to cold, or been guilty of some excess in eating or drinking, retires at night, with some degree of soreness in his joints, commonly attended with a general feeling of malaise, and wakes up in the morning with excessive pain, great tenderness on pressure of the affected parts, with considerable discoloration of the integuments, and probably utter inability to use his limb. He is feverish and uncomfortable; his pulse is strong and full; the skin is hot and dry; the bowels are costive; and the urine is scanty, high-colored, and loaded with urates. The joints become gradually more deeply involved; all the local symptoms increase in violence; an abundance of synovial fluid is effused; and if the inflammation be not speedily arrested, suppuration will probably take place, the event being preceded and accompanied by rigors and high constitutional excitement. The joints most liable to suffer from rheumatic synovitis are the knee, ankle, wrist, and elbow, those of the hip and shoulder being seldom involved. The articulations of the fingers also frequently suffer, and that of the great toe rarely escapes when the disease in the other joints is at all severe. The inflammation often begins simultaneously in several joints; or, if it commences in one only, it is extremely prone to involve others in its progress, especially its fellow on the opposite side. Thus, articular gout, or rheumatism of one knee, nearly always attacks the other knee before it finally ceases.

In chronic articular rheumatism, calculous concretions are liable to form, especially in the joints of the fingers, where they always prove a source of great inconvenience and suffering. Their character will be specially considered under the head of interarticular bodies.

Syphilitic synovitis belongs to the tertiary form of syphilitic diseases, and seldom makes its appearance until several years after the primary affection. It is most frequently met with in persons whose health has become exhausted by profuse courses of mercury and habitual intemperance. The larger articulations, especially the tibio-femoral and humero-ulnar, are its most common seat; but the smaller ones, particularly those of the fingers, are by no means exempt from it. A good deal of effusion of synovial fluid usually attends; the joint, in consequence, is swollen and fluctuating, motion is impeded, the parts are tender on pressure, and the patient is harassed by excessive pain, which is always worst at night, after he has become warm in bed. This latter circumstance, together with the history of the case, and the co-existence of syphilis in other structures, will always suffice to determine the diagnosis.

Of *strumous* synovitis particular mention will be made under a separate head; meanwhile, it is only necessary to state that the disease is almost peculiar to childhood, that it most commonly attacks the hip, knee, and elbow, and that it occurs only in persons of a strumous predisposition.

Morbid Anatomy.—The pathological changes which characterize this affection must necessarily vary a good deal, according to the nature of the exciting cause, and the duration of the morbid action. Under ordinary circumstances, and in the earlier stages of the malady, there is merely some degree of vascularity, along with slight opacity of the affected membrane, and some increase of the natural secretion. Here and there a little plastic matter is perceptible, either adherent to the inflamed surface, or floating about in the midst of the synovial fluid, which is usually, at the same time, more or less turbid, and abnormally thick and viscid. At a subsequent period, and especially in the more severe forms of the disease, the morbid appearances here enumerated exist in a still higher degree. There is a greater amount of lymph, the vascularity is more intense, as well as more diffused, and the synovial secretion is of a dirty, glutinous nature. In some instances the inflammation produces results still more disastrous; pus is freely poured out, and lining membrane, cartilage, and bone, are all involved in the ruinous consequences. In the worst cases the purulent fluid excites perforative ulceration, and escapes from the joint, the passages afterwards remaining fistulous. The surrounding structures are thickened by plastic deposits, softened, and unnaturally red and congested.

Suppuration, as a consequence of ordinary synovitis, is unusual. Arthritic inflammation of the joints also rarely terminates in the formation of pus; in articular syphilis it is occasionally witnessed, but still it is infrequent; in scrofulous affections of the joints, on the contrary, it is extremely common, and constitutes one of the great dangers of the disease.

The phenomena which announce the occurrence of suppuration are such as denote its presence in other parts of the body. After the disease has continued for some time, violent rigors set in, followed by high constitutional reaction and copious sweats, the patient being delirious, excessively restless, and tormented with thirst. The local symptoms are all materially aggravated, as is shown by the severity of the pain, the rapid increase of the swelling, the extraordinary heat, and the deep discoloration of the surface. If the pus be not speedily evacuated, hectic irritation supervenes, the appetite declines, the sleep is interrupted, the surface is drenched with perspiration, colliquative diarrhœa comes on, and death gradually closes the scene. Such, however, is not constantly the course pursued by the disease. In many cases ulceration takes place, and the matter thus finding a vent, ceases to commit farther ravages. In general, however, this does not occur until after the cartilaginous and osseous tissues have been deeply involved in the mischief, and the patient is doomed to carry out a miserable existence, with a stiff joint and a deformed limb, or to perish from the remote effects of the malady, after many months or perhaps several years of great suffering.

When a joint has once been inflamed, from any cause, it remains weak, and predisposed to disease, for a long time afterwards. The most trivial circumstance will then be able to induce a relapse, and re-awaken the symptoms with all their primitive severity. A frequent

repetition of the morbid action is sure ultimately to lead to disorganization of the component structures of the joint, and to complete loss of function. At all times, however, synovitis is a dangerous malady; plastic matter is generally poured out in considerable quantity, and there are few cases, however slight, in which there is not a strong tendency to adhesion of the opposite surfaces. In this respect, there is the greatest resemblance between inflammation of the serous membranes of the joints, and of the serous membranes of the viscera; in neither can this action go on to any extent, or for any length of time, without causing a flow of plasma, and wherever this substance exists, even very sparingly, there is danger of adhesion.

Treatment.—In discussing the treatment of an affection so various in its origin as synovitis, it is impossible to do more than to lay down a few broad general principles for the guidance of the surgeon. When the case is one of ordinary character, depending upon traumatic causes, or ordinary constitutional derangement, as a depraved condition of the secretions, or, finally, upon a suppression of the cutaneous perspiration, it will generally yield to the judicious application of the more common antiphlogistic measures, such as would be indicated in common inflammation of other parts of the body. If the symptoms be at all urgent, and the patient young and robust, blood must be freely taken from the arm, and the bowels be opened with an active purge, followed by the antimonial and saline mixture, with the addition of a sufficiency of morphia to promote perspiration, allay pain, and induce sleep. Mercury is administered if there is danger of structural lesion, or evidence of plastic effusion, and is carried to the extent of rapid but gentle ptyalism, with the hope of saving texture, and preventing adhesion. The diet is light and spare; the drink cooling and acidulated.

As it respects the local means, no time is lost in placing the joint at rest, in an easy, elevated position, over a pillow, or bolster, a piece of oil-cloth being spread upon the bedding to protect it from the dressings. If the patient be a child or rebellious subject, it may be necessary to put the limb in splints, or other suitable apparatus for the purpose of more certainly insuring its quietude, a matter of paramount importance in every case of inflamed joint, and therefore on no account to be slighted. The rest must be absolute and unconditional. If the affected surfaces are permitted to rub against each other, the effect must inevitably be to aggravate and protract the morbid action. There can be no half-way measures in such a case; the thing must be done right, or it might as well not be done at all. If perfect repose of a part is ever necessary in the treatment of inflammation, it is here, and it is therefore impossible to urge too strongly the importance of this measure upon the attention of the reader. From a neglect of this precaution I am satisfied that many joints are destroyed that might otherwise be preserved and restored to usefulness.

Of direct topical applications the most important are leeches and fomentations. Leeches, however, are, as a general rule, necessary only in the more urgent cases, attended with great pain, heat, and swelling, and then they should be employed freely, in such numbers and in such

a manner as the violence of the disease and the condition of the system may seem to indicate. Cupping is not to be thought of in inflamed joints, as the percussion attending the operation would cause more injury than benefit, to say nothing of the pain it would produce. In young and otherwise healthy subjects, especially during the hot weather of summer, cold applications, simple or medicated, will sometimes be exceedingly grateful and beneficial, promoting evaporation, allaying pain, and opposing swelling; but in general warmth combined with moisture will be found to be most soothing and agreeable, and should therefore have the preference. The best plan, however, in all cases is to consult the feelings of the patient, or to change the applications whenever they cease to be beneficial. My constant practice is to medicate the dressing largely with opium or laudanum, and I can hardly imagine an instance of synovitis where they can properly be dispensed with. When these means fail, or when the disease seems to be inclined to make rapid progress, there is no remedy so capable of affording relief as a blister, large enough to cover in the whole joint, well sprinkled with morphia, and retained until it has produced thorough vesication, the parts being dressed afterwards with a light emollient poultice or cloths wrung out of tepid water, with a piece of oiled silk over its surface to confine heat and moisture. The application is of course always premised here, as elsewhere, by proper depletion.

If matter should form, it is to be dealt with in the same manner as when it is deposited in other parts of the body. It is folly to look upon it in any other light. It is pent up; it is not amenable to the action of the absorbents, and must therefore be evacuated, and that early, before it has had time to cause serious structural evil. The incision need not, nay, must not be direct, but subcutaneous, small, not large; and when this precaution is observed and the orifice is immediately closed to prevent admittance of the air, nothing but good can result from it. A timid, cautious course will not answer here; as long as the pus is confined, just so long will it keep up pain, and do mischief to the parts with which it lies in contact; impairing and ultimately destroying their vitality, and thus putting both limb and life in imminent peril. The opening is of course made at a dependent part, and is repeated from time to time until the matter ceases to accumulate, the joint being well supported in the interval by the bandage, or by a roller and adhesive strips.

The surgeon need not always despair of effecting a good cure even after suppuration has taken place, if the above measures be cautiously carried out; the probability will certainly be that the joint will be stiff, but it should be recollected that an anchylosed joint is always better than no joint at all, provided of course that it be put in a proper position for future usefulness.

When the disease has passed into the *chronic stage*, our main reliance for dislodging it must be upon the steady, persistent use of the bandage, the douche, stimulating lotions, and friction. The joint, in the first place, is washed every morning and evening with warm water and castile soap, and then douched, when, being dried, it is thoroughly rubbed with some embrocation, or painted with equal parts of tincture

of iodine and alcohol, and finally it is put up in a roller, extending from the distal portion of the limb upwards, so as to afford gentle and equable compression to every part. Gradually the joint is moved and manipulated, at first very cautiously, and afterwards, as it becomes tolerant of the operation, more and more freely, until we succeed in restoring it to its original functions. Exercise must be taken upon crutches in the open air, but care must be used never to carry it to fatigue; and for a good while the limb must not be permitted to sustain the full weight of the body. In some cases the joint may be advantageously strapped with gum ammoniac and mercurial plaster, or a plaster made of opium and galbanum, to promote the absorption of effused fluids, and lend support to the weakened structures. If the case prove obstinate, the remaining symptoms may be scattered by the use of iodide of potassium with a minute quantity of bichloride of mercury, given three times a day, and pushed to gentle ptyalism. When anchylosis is found to be unavoidable, all motion of the joint should be prohibited, and the limb be placed in the position in which it is most desirable it should be in that event.

I have said nothing here of counter-irritation by tartar emetic pustulation, vesication with croton oil, and the use of issues, the seton, and the moxa; because, although sometimes serviceable, these means seldom afford the relief that has been so generally ascribed to them. I have certainly not, in my own practice, found them of much advantage, while occasionally I have thought they had acted decidedly prejudicially. Pustulation with tartar emetic is not only extremely painful, but not unfrequently, in delicate persons, creates nausea and other disagreeable effects, rendering its continuance improper. The use of croton oil is hardly less objectionable. An issue may sometimes be established beneficially near the affected joint with the actual cautery, or the hot iron may be drawn linearly over the joint, at several points, in a vertical direction. The seton, I never use in articular disease of any kind.

In *rheumatic* and gouty affections of the joints, our reliance must mainly be upon the use of colchicum, whose virtues here are unrivalled. It is not to be understood, however, that colchicum is infallible; there are, undoubtedly, cases wherein it either entirely fails, or in which its effects are but little apparent; but in general it will answer an admirable purpose, promptly relieving pain, depurating the blood, and expelling or neutralizing the arthritic poison. A little preliminary treatment by way of purgation, if not also by venesection, will usually be proper, and then the colchicum, given in drachm doses, with a grain of morphia, at bedtime, and followed by a gentle laxative in the morning, will seldom disappoint our highest expectations. The pain will speedily vanish, fever, swelling, and stiffness will subside, the lithates will disappear from the urine, and health will soon resume its wonted sway. Where there is much arterial action, as evinced by a full, bounding, and frequent pulse, the tincture of aconite will come in play, in doses of from three to four drops every three hours, or the saturated tincture of veratrum in from four to eight drops, either alone, or, as I generally prefer, in union with a minute quantity of antimony, and the sixth or

eighth of a grain of morphia, so as to produce a more powerful diaphoretic impression. In the use of these several articles, great caution is needful that the dose be not carried too far, or the remedy continued longer than is necessary. Their agency is potent, and demands vigilance to keep it in proper check.

Along with these means, with a view of neutralizing the acid state of the blood, free use should be made of alkalies, of which the bicarbonates of soda and potassa, in the proportion of twenty grains of the former to ten of the latter, are the most eligible. The medicine should be repeated at least every six hours, in two ounces of soft water.

When the disease is rebellious, calomel and opium will be found serviceable, but the former of these articles should be used with great caution. As a local application, nothing will be found more beneficial than soap liniment and laudanum, in the proportion of two parts of the former to one of the latter, retained constantly upon the affected joint with a piece of flannel, covered with oiled silk. This may be succeeded, if the disease seems inclined to linger, by a fly-blister.

In *syphilitic* synovitis, the great remedy, as stated elsewhere, is iodide of potassium, aided, in obstinate cases, by mercury, carried to gentle ptyalism. Other means, both general and local, and such as have already been adverted to, are not to be neglected.

SECT. IV.—DROPSY OF THE JOINTS.

By this expression is meant an accumulation of fluid in the interior of an articulation, generally a result of chronic disease of the synovial membrane. It was formerly supposed that this affection occurred only in the ginglymoid joints, but more careful examination has taught that it is also occasionally met with in the orbicular, particularly in that of the shoulder. Of the ginglymoid joints, those most liable to be attacked are the knee, elbow, and ankle, especially the first, which is probably oftener dropsical than all the other articulations together.

The *causes* of articular dropsy are various; some being local, others constitutional. Among the former may be classed different kinds of accidents, as sprains, blows, concussion, dislocation, and the presence of inter-articular concretions, making a direct impression upon the synovial membrane, and inducing an inordinate secretory action in its vessels. Severe and long continued exercise, producing excessive fatigue in the joints, may, no doubt, excite the disease.

The constitutional causes are not always very obvious. In most of the cases of this disease that have fallen under my observation, it was associated with, or directly dependent upon, a rheumatic state of the system, as was clearly evinced by the consentaneous existence of rheumatic suffering in other parts of the body. Gout occasionally produces a similar effect, but much less frequently. In tertiary syphilis, it is not uncommon to meet with dropsy in several of the joints simultaneously, especially in those of the knee and elbow, and I believe that this effect will be more certainly brought about if the

individual has been subjected to severe courses of mercury for the cure of that malady in its primary stages. A strong predisposition to the disease is sometimes observed, and, under such circumstances, the slightest causes are generally sufficient to call it into action. In weak, strumous subjects, it is occasionally a sequel of typhoid fever, scarlatina, measles, and smallpox. Suppression of the cutaneous perspiration may also induce it; and in many cases it comes on without any assignable cause whatever.

Symptoms.—The symptoms of this disease are generally well marked, the most prominent and reliable, in a diagnostic point of view, being a loss of the natural contour of the joint, and the existence of a soft, elastic, and irregularly circumscribed swelling. The skin ordinarily retains its normal color, and the motion of the articulation, although considerably impeded, is rarely attended with much pain or inconvenience. The tumor affords distinct fluctuation, and is most conspicuous where the ligaments of the joint are loose and superficial. In the wrist, for example, it is most apparent at the anterior and posterior aspects of the joint; in the ankle, in front of the malleolar processes, a short distance above the instep; in the shoulder, in the space between the deltoid and pectoral muscles; and in the knee, at the sides of the patella. In the latter, where the swelling is often double, its shape and consistence are materially influenced by the movements of the limb, being softer and more decidedly fluctuating in extension than in flexion. Pressure upon the tumor is seldom productive of much pain; generally, indeed, it causes merely a little uneasiness, or a sense of tenderness. In cases of long standing there is sometimes considerable enlargement of the subcutaneous veins, but this is uncommon.

The *progress* of these dropsical affections is usually very chronic, many months often elapsing before the tumor attains any considerable bulk. Sometimes, however, the reverse is true; in the knee, in particular, I have repeatedly seen large collections occur in three or four weeks. Their march is usually most rapid in rheumatic and gouty subjects, and after attacks of the exanthematous fevers.

In regard to the *diagnosis*, the history of the disease, the change in the contour of the joint, the fluctuating and indolent character of the swelling, and the comparative freedom of motion of the affected structures, will generally serve to prevent error. Should there, however, be any doubt after the swelling has been thoroughly scrutinized, the difficulty may at once be decided by the insertion of the exploring needle, the nature of the escaping fluid being characteristic.

Morbid Anatomy.—The pathological anatomy of these collections has not received the attention it merits, from the fact that it is rare that an opportunity is afforded of inspecting the affected joint. Enough, however, is known to show that there is generally, especially in cases of long standing, considerable opacity and thickening of the synovial membrane, with some degree of vascularity, the vessels being spread over the surface of the membrane in delicate, arborescent lines, widely separated from each other. Occasionally slight deposits or patches of lymph exist, giving the part a rough, uneven appearance, but this is infrequent. The cartilages and bones present no perceptible changes,

nor do the muscles and other parts around the joint, except that they are more or less displaced by the dropsical distension. When the accumulation is very great the capsular ligaments, pressed upon in every direction, become very much stretched and attenuated. Cases occasionally occur where the ligaments are so much distended as to give way, thus allowing the fluid to diffuse itself among the surrounding structures.

The dropsical fluid is generally of a pale, yellowish, straw or amber color, and of a ropy, unctuous, or sero-oleaginous consistence; sometimes it is turbid, whey-like, or sanguinolent, and intermixed with flakes, shreds, or masses of lymph. Its quantity is variable, depending upon the size of the joint, the duration of the case, and other circumstances. In the knee it frequently amounts to from sixteen to twenty ounces.

Prognosis.—The prognosis is always more favorable, other things being equal, when the swelling is recent and small than when it is of long standing, large, and attended with organic lesion of the synovial membrane. In the latter case the disease is often extremely obstinate, and may become dangerous, as it is liable to be followed by anchylosis, or ruin of the articular cartilages and bones.

Treatment.—In entering upon the treatment of this affection, the practitioner will generally derive his most valuable indications from a consideration of the nature of the exciting causes, which, if properly understood, are often easily removed. It must be constantly borne in mind that dropsy of the joints, like dropsy everywhere else, is not a disease, but merely a symptom of disease, and hence one of the very first and most important objects is to endeavor to remove the lesion upon which the presence of the fluid depends. The question will, therefore, necessarily arise, in every instance, what has been the origin of the affection? Has it been local or constitutional? Upon the success with which this question is answered will mainly depend the success of our remedies.

When the affection is of a local nature, caused by a sprain, contusion, or other injury, local remedies alone will generally suffice to effect a cure, especially if assisted by an occasional purge and a properly regulated diet. The means to be chiefly relied upon are, perfect quietude of the affected joint, embrocations, and vesicants. Without rest, absolute and unconditional, little progress can be made in any case; it should of course be conjoined with proper elevation and an easy, relaxed position of the parts. In the milder varieties of dropsy, frictions with iodinized lotions, soap liniment, camphorated spirits, and mercurial unguents seldom fail to make a rapid and decided impression upon the absorbent vessels of the joint, as is shown by the speedy diminution of the size and tension of the swelling. Whichever of these means be employed, they should be applied at least twice a day, being rubbed upon the whole of the affected surface with the bare hand until a full glow is produced, when the friction should be discontinued, to be repeated in the same careful, but efficient, manner at the next operation. In the meanwhile, the parts should be well supported with the bandage, extending from the distal extremity of the

limb, the compression thus derived powerfully aiding in the reduction of the effused fluid. When it is evident, from the gradually decreasing volume of the sac, that the absorbents have been fairly roused, the inunctions may be advantageously preceded by the cold douche, or by the hot and cold, applied in immediate succession; a plan which I have often seen productive of the most salutary effect.

When, as occasionally happens, there are evidences of incited action, the surface being hot and tender, refrigerating lotions, consisting simply of cold water, or of water impregnated with acetate of lead and opium, must be employed; for as long as the capillary vessels are over-active little benefit can be hoped for from sorbefacients, properly so called. Leeching and brisk purgation may even be necessary under such circumstances.

In obstinate cases, I have found no topical remedy at all comparable to vesication with cantharides, left on until the epidermis is thoroughly raised, the discharge being afterwards promoted by emollient dressings, and the blister reapplied as soon as the surface is partially cicatrized. This method is much more salutary than that of keeping open the sore by means of irritating salves; it seems to produce a more direct effect upon the absorbent vessels, and is at the same time much less painful, an object of great importance in the treatment of all chronic maladies.

I have no patience, in this disease, with pustulation with tartar-emetic ointment and croton oil, so much vaunted by certain practitioners, believing it to be much more productive of harm than of benefit; and, as to the moxa, issues, and setons, I have never had any reason to employ them, having always succeeded with other and milder means.

When the affection is clearly of a rheumatic, gouty, syphilitic, or strumous origin, remedies calculated to meet these several contingencies are clearly indicated, and nothing short of their exhibition will be likely to be of any permanent benefit. Colchicum, mercury, iodide of potassium, and other kindred articles, are the means chiefly to be relied upon for relief under the circumstances. When the dropsy is symptomatic of fever, or some of the eruptive diseases, it often disappears spontaneously, as the patient improves in health and vigor, or readily yields to mild measures, particularly tonics, and change of air. Ordinary hydragogue medicines do little or no good in this affection in any of its forms.

As the joint will necessarily remain weak for a long time after the removal of the fluid, it should be supported with a laced-cap, or suitable bandage, kept cool by frequent ablutions with alcohol and water, and not be exposed to much fatigue.

Finally, should the disease resist the means now suggested, or continue to increase, so as gradually to impede the motions of the joint, accompanied with wasting and coldness of the limb, relief should be attempted by *evacuation* of the fluid by subcutaneous puncture. The operation may be performed either with a delicate trocar or bistoury, inserted in such a manner as to make a valve-like opening, which should be closed the moment the fluid has been drawn off with

collodion, a compress, and bandage, the object being to exclude the entrance of the air. The instrument should be introduced at the most dependent and superficial portion of the swelling, at least an inch and a half beyond its boundaries, its point being carried along the cellular tissue until it reaches the sac, which is then pierced in the usual manner. Thus performed, no possible injury can result from the operation, while, by removing the fluid, over which the absorbents have no longer any control, it affords the only chance of relief. For some days after the operation the limb is kept perfectly quiet, light diet is enjoined, and every precaution is taken to prevent inflammation. Re-accumulation is guarded against by the means already indicated.

I have not been so bold as to use *injections* for the permanent cure of this affection, for I candidly confess I have hitherto been afraid of them, knowing that the practice must be fraught with danger. The article which has been used for this purpose, by Velpeau, Bonnet, and others, is tincture of iodine, in the proportion of one part to two, three, or four of water, introduced subcutaneously, with a syringe, to the amount of from two to four ounces, and retained for one or two minutes, the joint being pressed slightly during its sojourn, in order to bring the solution fully in contact with the diseased sac. It is then permitted to flow off spontaneously, when the opening is carefully closed, and the case treated on general principles, the great object being to keep the resulting inflammation within proper limits.

Of the safety, and, consequently, the propriety of this operation great doubt is entertained by many practitioners, and, I think, justly so; for, although it has unquestionably succeeded in some cases, yet it is equally certain that in others it has been followed by such a degree of inflammation as to imperil both limb and life. Unfortunately we have no reliable statistics to serve us as guides in this matter.

SECT. V.—MOVABLE BODIES WITHIN THE JOINTS.

Various kinds of bodies, mostly movable, but sometimes adherent, are liable to form in the cavity of the joints, where, interfering with the functions of the opposing surfaces, they become a source of much annoyance, and sometimes even of intense suffering. Ambrose Paré, in 1558, seems to have been the first to call attention to this subject, which has since been made a frequent object of inquiry by some of the most able and distinguished surgeons.

1. Those bodies, usually known under the name of inter-articular cartilages, or osseous concretions, have been met with in various articulations, particularly in those of the knee, elbow, wrist, and jaw, the first, however, being apparently their favorite seat, for it is there that they occur most frequently, and that they attain their greatest bulk. The orbicular joints rarely suffer from them; a circumstance which does not admit of easy explanation, although it may be assumed that it depends mainly upon the conformation of the articular surfaces opposing their development in the one case, and promoting it in the other. It is difficult to determine why the tibio-femoral articulation

should suffer so much more frequently in this way than other joints of its class, unless the fact is attributable to its larger size and its greater liability to all kinds of injury calculated to excite inflammation in its lining membrane.

The size, number, form, color, consistence, and structure of these bodies are liable to much diversity. In the knee, where they attain their largest bulk, they sometimes acquire the dimensions of the patella, or of a hen's egg, though commonly they are much smaller. Their number is generally in an inverse ratio to their volume. When very large there is often only one, whereas under opposite circumstances there may be as many as a dozen, twenty, thirty, or even more. In one case, as many as sixty were found. The largest number I have ever known to be removed from one joint was thirty-eight, varying from the volume of a pea to that of a pullet's egg. They are, for the most part, of a whitish, grayish, or pale straw color; while their consistence, like their structure, ranges from that of fibro-cartilage to that of bone, with every possible intermediate shade. Their shape is generally very much modified by that of the joint in which they are developed. Thus, in the knee they are often, if, indeed, not commonly, of an irregularly flattened figure, not unlike that of the patella, or they resemble a disk, convex on one side, and concave on the other, in conformity with the outline of the condyles of the femur and the head of the tibia. In many cases, again, even in the knee, they are of a lenticular, rounded, or ovoidal shape. Consisting usually of a single mass, they are sometimes marked off into several lobules, connected together by a kind of condensed cellular substance. Their surface may be perfectly smooth, or partly smooth and partly rough, and I have seen specimens which presented numerous hollows and even distinct perforations, giving them a porous aspect. Their weight depends altogether upon their structure.

Structure and Development.—The structure of these bodies varies. In their earlier stages it is generally fibro-cartilaginous, but as they advance in age they assume the character of cartilage, and ultimately that of osseous matter. The process of conversion from fibro-cartilage to bone is generally very gradual, and almost always begins in the centre of the concretion, though occasionally it displays itself simultaneously both at the centre and at the periphery, or first at the surface and afterwards in the interior. When several such bodies coexist it often happens that they exhibit material differences in their development; some being comparatively soft, evidently from their cartilaginous nature, and others very hard and osseous.

The mode of development of these bodies has excited much discussion, and even now, notwithstanding the time and pains that have been expended upon it, the question can hardly yet be said to be definitively settled. Without recounting any of the many speculative views that have been advanced upon the subject, which the scope and character of this work forbid, it must be sufficiently apparent to every pathologist that they invariably take their rise in plastic effusion, excited under the influence of inflammation. This matter no doubt soon becomes organized, and being constantly com-

pressed by the opposing surfaces of the joint, is at length moulded into the peculiar shape which is found to distinguish these bodies when they have attained their maturity. When the friction is very great their surface will generally be proportionably smooth or even polished, and their consistence will also be more dense than when the pressure is less. The fact that these bodies are susceptible of various transformations shows that they have an appropriate circulation, and also that this circulation continues in force long after they lose their attachment to the synovial membrane, upon the free surface of which it is evident that they are originally developed, and not beneath it, in the subserous tissue, as has sometimes been alleged, the excessive closeness and density of that substance being altogether incompatible with such an occurrence. At what period they become loose, or floating, is not determined; the circumstance probably depends very much upon the amount of friction to which they are subjected in the different movements of the articulation. Another cause which doubtless contributes to their detachment is the atrophy which their vessels experience after their development has reached the osseous, or cartilago-osseous point. Their primitive connection is usually effected through the medium of a short, narrow pedicle.

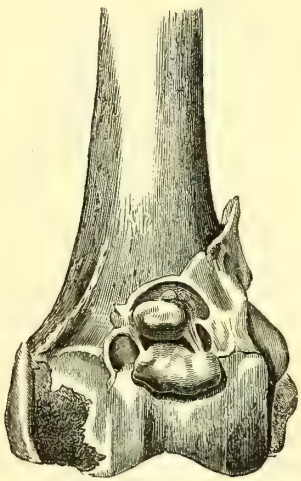
The size and shape of these bodies are well represented in the adjoining cut (fig. 224), from a drawing of several in a collection of

Fig. 224.



Loose articular concretions.

Fig. 225.



Attached articular concretions.

thirty-eight, for which I am indebted to Dr. John T. Berry, of Kentucky, who removed them, without any untoward occurrence, from the left knee of a colored man, upwards of thirty-five years of age. When quite young, he received a slight injury upon the joint, which, though not painful, was soon followed by considerable enlargement. Two years prior to the operation performed for his relief, he perceived a small, round, movable tumor, immediately above the external condyle, which was followed in about twelve months by two others just above the inner part of the knee. These swellings gave him but little trouble, with the exception of some stiffness in the articulation. Occasionally, however, the ex-

ternal one changed its position, slipping round to the anterior surface of the thigh, above the patella, where it interfered so much with his progression that the man was immediately obliged to sit down, and push it back to its original position. An incision being made into the external tumor, the concretions were readily extracted, having all been contained in one sac, of a dense, firm consistence, which occupied the lower part of the front of the thigh, and communicated with the cavity of the joint. There were thirty-eight altogether, from the volume of a pea to that of a pullet's egg, of a whitish, glistening appearance, rough or pitted on the surface, and of various configurations, some being spherical, some oval, and others lobulated and extremely irregular. The preceding cut (fig. 225) exhibits several bodies of this kind as they lie in the joint attached to the synovial membrane.

Symptoms.—The symptoms which announce the presence of these inter-articular bodies are often so well marked as to render it impossible to be deceived by them. This is particularly true when they occur in the knee. There are, however, on the other hand, cases where the nature of the disorder is so obscure as to elude, at all events for a time, the most careful examination. In general, it will be found that the intruder, if large, will cause but little pain, whereas if it be small, and susceptible of slipping about, or of becoming wedged in between the articular surfaces, it will occasion severe suffering, followed, if the accident be frequently repeated, by violent synovitis. When, for example, the inter-articular substance gets behind the patella, as the patient is standing or walking, he is often seized with a sudden pain, and is instantly compelled to sit down, in order to save himself from falling. In the night, his sleep is liable to be disturbed by any inadvertent movement of the limb that may favor displacement of the concretion; and when the disease has existed for a long time, and is attended with much relaxation of the ligaments, any accident of the kind, however trivial, is apt to be succeeded by excruciating agony, sometimes carried to such an extent as to produce fainting.

When the extraneous substance gets in the habit of slipping about, it is sure not only to create pain, keeping the joint constantly tender and uncomfortable, but also enlargement, both by interstitial deposits in the surrounding structures and increase of synovial fluid. The intumescence, however, is rarely so great as to prevent the surgeon from feeling the concretion, or pushing it about from one point to another. In the knee, it generally forms a marked projection on the side of the patella, more frequently on the external than the internal, its outline being distinguishable both by the sight and touch. Cases occur in which, retreating to a particular part of the joint, it becomes comparatively harmless, the patient being so comfortable as to imagine he has got rid of it. After some time, however, usually very brief, it leaves its lurking place and goes to some other, thus causing a renewal of all the former trouble.

As the affection progresses, the joint becomes more and more tender, swollen, and feeble; the synovial membrane, constantly fretted by the friction of the concretion, pours out an additional quantity of its appropriate secretion; the ligaments become greatly relaxed, and

the patient, at first merely limping, is at length rendered permanently lame and helpless.

Diagnosis.—The most important diagnostic signs are the suddenness with which the joint is deprived of its use, the severity of the concomitant pain, the ability of the surgeon to feel, see, and push about the concretion, and the facility with which the patient can generally relieve himself by his own efforts. The chronic nature of the disease, the absence of external injury, and the frequent recurrence of the symptoms from the most trivial circumstances, afford important collateral evidence of the character of the affection.

Although the complaint under consideration is not generally dangerous, yet, as it often materially interferes with the movements of the joints in which it occurs, and does not admit of permanent relief, except by a surgical operation, which is itself always hazardous, we cannot be too cautious in giving our prognosis. The removal of the concretion, by the absorption of its substance, is impossible.

Treatment.—The treatment is palliative and radical. When the concretion is moderately large, or if, whatever its size may be, it is inclined to remain quiet, and not to occasion any material inconvenience, or to produce any serious embarrassment in the functions of the joint, the most judicious plan will be to let it alone, care being taken to support the parts with a laced-cap, or some other suitable contrivance, calculated to prevent the substance from slipping about, and thus doing harm. The relief thus afforded, however, is generally very transient, and we are, therefore, compelled to adopt other and more efficient measures.

Great objection has been urged against the use of the knife in the treatment of these inter-articular bodies, and not without just reason; for, beyond question, all interference of the kind is eminently dangerous both to limb and life. This remark, however, is more particularly applicable to the old method of opening the joints; that is, by direct incisions, an operation which was often followed by most serious consequences, and which should, therefore, have long ago been discarded. We have no statistics to show the mortality of the operation, but enough is known to satisfy any unprejudiced mind that it must have been very fearful, judging from the number of fatal cases and of hair-breadth escapes that have appeared in the journals of this and other countries. Even where the utmost precaution was observed in regard to the preparation of the system, and where the operation was performed with the greatest possible skill and tenderness, the result was often most disastrous; or, if the patient recovered, it was only after the most anxious attendance that his safety was finally insured. A case, it is true, occasionally got well without a solitary untoward symptom, as that, for example, communicated to me by Dr. Berry, above referred to, but it is evident that such a case cannot be used as an argument in favor of the procedure.

None of these objections lie, I conceive, against the operation devised nearly simultaneously by Mr. Goyrand, of Aix, and Mr. Syme, of Edinburgh. This operation, in which the knife penetrates the joint subcutaneously, prevents the admission of air, and is, therefore, com-

paratively free from danger. In most of the cases in which it has been performed the success has been complete. Only a few instances have occurred where it was followed by any considerable inflammation, and in none, so far as I know, has it led to loss of limb or life. Before, however, even such an operation is undertaken, I should deem it a matter of paramount importance to subject the patient to a most rigid preliminary course of treatment. With this view, he should be confined to the house for at least a fortnight, with the affected joint in a perfectly quiet condition; the bowels and secretions should receive careful attention; and the diet should be perfectly plain and simple, all animal food being scrupulously interdicted. Such precautions are eminently proper in all cases, but particularly so if one of the larger articulations is concerned, when, if severe inflammation follow, the worst consequences may be expected.

The subcutaneous section of the knee will serve as a type of the operation upon the other joints. The limb being extended upon a table, the foreign body is brought to the upper and outer side of the patella, beneath the large external muscle, where it is to be securely held by an assistant, while the surgeon introduces a long, narrow bistoury, from above downwards, into the synovial pouch, which is then freely divided, so as to permit the concretion to be pushed through the opening into the subcutaneous cellular tissue, or among the structures exterior to the joint, entirely beyond the serous lining. The puncture is covered with collodion, and a compress is gently bound upon the knee, immediately over the upper edge of the concretion, the object being to promote speedy union of the edges of the articular wound. The limb is kept perfectly at rest, free use being made of cold water-dressing and other antiphlogistics. When the inner wound is healed, the extraneous substance may be removed by simple incision; or, if not in a situation to cause inconvenience, it may be allowed to remain in its new position, where it will soon become imbedded by plastic material, and prove comparatively harmless.

2. The movable joints are occasionally the seat of gouty concretions, which, from their color and consistence, have received the name of *chalk-stones*. They are composed of urate of soda, a peculiar fatty matter, phosphate and carbonate of lime, and a minute quantity of carbonate of magnesia. In an old man, whom I examined some years ago, I found these concretions in nearly all the principal joints of the body, in small amorphous masses, of a whitish color, and of a soft, unctuous consistence. Sometimes they are perfectly smooth and round; more commonly, however, they are rough and irregular, grooved or nodulated. They are generally small, but have been observed of the volume of an egg. Their origin is always connected with a gouty diathesis.

The *treatment* of this form of concretion is chiefly constitutional, directed to the removal of the gouty diathesis, with which its origin is so intimately associated. Colchicum and aconite, with an occasional mercurial purge, and free use of lemon-juice, constitute the chief remedies. For a long time, means should be employed to depurate the blood, or, what is the same thing, to keep up a healthy state of the

digestive organs, and an active condition of the renal secretion. If the joint ulcerate, or threaten to do so, extrusion should be effected; in the former case, by direct incision, and in the latter by the subcutaneous method.

3. The synovial membrane is occasionally the seat of *fibrous tumors*. They occur in different joints, but principally in that of the knee, where several sometimes exist together, varying from the volume of a bean to that of a large almond. On one occasion, several years ago, I removed a growth of this description, which was fully as large as a pullet's egg. It was of an elongated, flattened, pyriform shape, and was attached, by a short, narrow pedicle, to the upper and anterior part of the inner condyle. The patient, a man of twenty-seven, had labored under synovial irritation for many years, attended with partial anchylosis, and much pain and tenderness, which were always aggravated upon the slightest exertion. A subcutaneous incision being made into the articulation, the tumor was detached by a few turns of the point of the knife, and immediately extracted with a very delicate, slender pair of forceps. The wound, closed with collodion, healed by the first intention, no untoward symptom occurring, as far as the joint was concerned. Some erysipelas, however, appeared on the skin, and a week afterwards a large abscess formed at the inner and middle part of the thigh, which somewhat retarded recovery. Another tumor, doubtless of a similar nature, was found occupying the deeper portion of the joint, but, dreading farther interference, it was thought best not to meddle with it. The functions of the knee were much improved by the operation.

Fig. 226.



The tumor, after ablation, was found to be of a pale greenish color, extremely firm and tough in consistence, smooth, glistening, and somewhat vascular on the surface, and of a distinctly fibrous structure.

4. There is a curious growth of the synovial membrane, to which, from the peculiarity of its appearance, the term *fimbriated* has been applied. It is chiefly observed in the large joints, as in those of the knee and hip, and consists of innumerable little bodies of all sizes, from that of a millet seed up to that of a pea, of a pale yellowish or whitish color, and bearing a very close resemblance to the epiploic appendages of the large intestine. Of a smooth, glistening appearance, they stud the free surface of the synovial membrane in every direction, being connected to it either by a broad base, or, as is more generally the case, by a narrow, slender

pedicle. Their structure is evidently of a fibro-cellular character, originating in a deposit of plastic matter, which assumes the peculiar arrangement in question in consequence of the friction exerted upon it by the opposing surfaces of the joint in which the substance is effused. The preceding cut (fig. 226), for which I am indebted to Mr. Pirrie, affords an excellent illustration of this form of morbid growth.

The symptoms occasioned by the fimbriated synovial membrane are altogether of a mechanical character, consisting of pain and stiffness, and of a grating sensation during exercise, along with more or less swelling in and around the joint, from inflammatory deposits. There are no diagnostic symptoms, and the treatment must, therefore, be conducted upon general antiphlogistic principles.

SECT. VI.—TUBERCULOSIS OF THE JOINTS, ESPECIALLY AS IT AFFECTS THE HIP.

The joints are often the seat of tubercular disease, beginning either in the areolar substance of the bones, the articular cartilages, or the synovial membranes, or, as perhaps not unfrequently happens, simultaneously in all these parts. The affection, which is almost peculiar to children under ten years of age, generally pursues a chronic march, and seldom stops until it has produced extensive textural changes, consisting in the destruction, either partial or complete, of the affected articulation. Constitutional involvement is usually well marked, especially in the latter stages of the malady, when it is also not uncommon to find serious lesion of some of the internal viscera, as the lungs, spleen, and mesenteric ganglions. The disease, as the name implies, can only occur in persons of a strumous diathesis, and as it displays itself, in its most characteristic form, in the hip-joint, I shall select that as the basis of the remarks which I shall offer respecting its pathology, symptomatology, and treatment.

Strumous disease of the hip-joint, usually called *coxalgia*, occurs at different periods of life; but the age at which it usually shows itself is early childhood. As far as my experience goes, I am satisfied that it is by far most common from the third to the seventh year. Cases of it are occasionally witnessed as early as the eighteenth month, and a good many just before the time of puberty. After the twentieth year it is exceedingly infrequent.

The malady occurs in both sexes; but I have met with it much oftener in the male than the female. It is occasionally observed in several members of the same family. It is said to be sometimes congenital; but of this I have never had any personal proof.

Causes.—In the great majority of cases, hip-joint disease arises spontaneously, defying all conjecture in respect to its origin. The surgeon, it is true, is often told that the little patient received a fall, blow, or kick upon the affected parts, or that the joint was sprained, bruised, or twisted, several months, perhaps, before the appearance of the characteristic symptoms; but my experience is that such information is usually little reliable, or that, if the occurrence did take place

as stated, it excited but little, if any influence, in developing the malady. Unless very severe, such accidents would no more occasion tuberculosis of the hip-joint than a similar injury of the chest would produce tuberculosis of the lungs, or of the head tuberculosis of the arachnoid membrane. The possibility of such an occurrence cannot, of course, be denied, but it may safely be affirmed that it is infrequent, and therefore exceptional.

Exposure to cold, intense or protracted, is usually enumerated as another exciting cause of the malady, and generally with a better show of reason. That it may, in such an event, conduce to this result, especially in a child of feeble constitution, ill-fed, and with an impoverished state of the blood, hardly admits of doubt. It is well known that cold is one of the most common and powerful causes of pulmonary consumption and of strumous disease of the neck. Living in damp, under-ground, and ill-ventilated apartments operates in a similar manner. Simple suppression of the cutaneous perspiration, suddenly induced, as when a person is exposed to a heavy current of air, might, it may be presumed, easily occasion the affection in one predisposed to its occurrence.

The use of unwholesome food, derangement of the digestive organs, imperfect assimilation, or inadequate nutrition, however induced, are also among the causes of this disease, as they are among the causes of tuberculosis in general. Protracted courses of mercury, establishing a severe drain upon the system, followed by the abstraction of the plastic elements of the blood, may lead to similar results. The same is true, though the circumstance does not always readily admit of proof, of the exhaustion consequent upon copious and protracted hemorrhages, infantile cholera, chronic diarrhœa, scarlatina, measles, smallpox, and of typhoid, intermittent, and other fevers; in short, of everything that has a tendency to enfeeble the system and degrade the blood.

It has been asserted that rheumatism is a common cause of this disease, but I have never seen an instance corroborative of the truth of the statement. The fact is, it is not at all probable that that affection ever exerts such an influence; for, in the first place, it is well known that tuberculosis is exceedingly rare in rheumatic subjects, and, in the second, that, when disease of the hip-joint shows itself in persons of this description, it is very different from the strumous disorder under consideration.

No one who has often met with this affection can have failed to notice the different temperaments of those who are most liable to suffer from it. These are the sanguine and the lymphatic, or a combination of these. In the former the characteristics are, a rosy state of the countenance, a well-developed muscular system with a tendency frequently to a certain degree of embonpoint, an active circulation of the skin, warmth of the extremities, and an active state of the intellect. In the lymphatic temperament, the face is pale, often swollen and pasty, the muscles are soft and flabby, the feet are cold, the cutaneous circulation is feeble, the mind is sluggish, and the pupil is dilated. In both, but particularly in the latter, the belly and upper lip are frequently

remarkably tumid, and most expressive of the tubercular diathesis. These two varieties of temperament, with their various modifications, deserve careful consideration, as they form the basis of important therapeutic indications.

It is rare that both hip-joints are involved in this affection. During its progress, however, it becomes occasionally complicated with other strumous maladies, as Pott's disease, psoas abscess, ophthalmitis, mesenteric disease, strumous enlargement of the lymphatic ganglions of the neck, and pulmonary phthisis.

Symptomatology.—Tuberculosis of the hip-joint may be described as consisting of three stages, each characterized by distinctive symptoms and pathological changes, as well as requiring peculiar treatment. As this division is not imaginary but real, it is deserving of the greatest attention.

The symptoms by which the disease is usually announced are of so obscure and stealthy a character as to render it very liable to be mistaken for other affections of the joint. The first circumstance which commonly attracts attention, especially if the patient be a child, is a feeling of fatigue after exercise, with slight pain in the knee, and a disposition to drag the limb, thus giving the gait a stiff, awkward appearance. In this manner the case may progress for several weeks, or, indeed, even for several months, with, perhaps, hardly any perceptible aggravation. The child still goes about, taking his accustomed exercise, and manifesting the same interest as formerly in his out-door amusements. Gradually, however, the pain increases; there is now a distinct limping, and the sleep at night is apt to be disturbed by spasmodic twitches of the extremity. The pain is usually referred to the knee, particularly to its inner side, and is either sharp and lancinating, or dull, heavy, and aching. It is sometimes felt in the very depth of the joint, but more frequently it is superficial, as if it were just beneath the integuments. Exercise, or motion of any kind, always increases it, and it is generally worse at night than in the day; damp states of the atmosphere, suppression of the cutaneous perspiration, and disorder of the digestive organs also frequently aggravate it. The knee, on inspection, is found to be free from swelling and discoloration, and commonly quite tolerant of rough manipulation, as motion, pressure, and percussion. Occasionally the pain is of a neuralgic nature, and distinctly periodical in its occurrence, very similar, in this respect, to the paroxysms of an intermittent fever; the attack, perhaps, coming on early in the evening, and, after having continued for a few hours, returning about the same time the next day. This form of pain is most frequent, as far as my observation enables me to judge, in persons living in a malarial atmosphere.

It is not often, however, that the pain, whatever be its character, is confined entirely, at this stage of the disease, to the knee; or, if it be so at first, that it remains there exclusively for any length of time. In general, it extends also to the thigh and leg, sometimes along the front, now along the sides, especially the inner, and now along the posterior surface, in the direction, apparently, of some nervous trunk, as the crural, obturator, saphenous, or sacro-sciatic. I have known cases

where the pain was felt most keenly at the tendo-Achillis, just above the ankle-joint, and in one instance, under my charge not long ago, it was distressingly severe over the instep. Sometimes, again, the pain seems to shift from one of these points to another, being, perhaps, most severe, at one time in the knee, and at another in the thigh, leg, or foot. It is proper also to add that the pain is generally not persistent, but that the patient has frequently long intervals of ease or of comparative comfort.

Various explanations have been offered respecting the occurrence of pain at the knee, but I cannot say that any of them, so far as it is in my power to appreciate them, afford any satisfactory solution. It has been supposed, for example, that it is owing to an inflamed condition of some of the principal nerves of the limb, especially the obturator, which, as is well known, occasionally sends a small filament to the hip-joint; but what connection has this nerve with the knee? None whatever; and the same is true of the other nerves of the lower extremity. Nor, in my judgment, is the opinion that it is owing to disease of the long head of the femoral muscle any more plausible. This muscle lies over, and is attached to, the capsular ligament of the hip-joint; but even supposing, what is not very probable at this early stage of the malady, that it participates in the morbid action, how could it give rise to the pain in the knee, leg, and foot? Again, it has been imagined that the suffering in question is caused by inflammation of the cancellated structure of the head and neck of the thigh-bone; but if this be so, we have no positive proof of the fact. Our knowledge, then, in regard to this matter, is wholly conjectural, nothing more; a circumstance so much the less to be regretted, because it is really not of the least practical importance how the pain is produced, provided it is recollected that it usually manifests itself first at the knee. So far as this is concerned it is a symptom of great diagnostic value.

After some time, varying from a few weeks to as many months, the pain shifts to the hip and its neighborhood; or, if it do not entirely forsake the knee, it is generally less constant and severe there than it was in the first instance, or soon after the commencement of the morbid action. Commonly it is most intense and persistent directly over the articulation, deep-seated, and of a dull, gnawing character. At times it is perceived most keenly in the sacro-sciatic notch, between the great trochanter and the spine of the ilium, or in the upper and outer part of the groin. Occasionally, again, it exists simultaneously at all these points, although not in an equal degree; or, as it leaves one, it fastens itself upon another. In rare cases the pain appears in the hip before it shows itself in the knee, thigh, or leg. Pressure upon the gluteal region, motion of the affected joint, and percussion of the knee, the leg being flexed at a right angle, or of the sole of the foot, the limb being extended, always augments the pain, and leads to the detection of its seat.

As yet, there is no sensible impairment of the general health; the appetite is good, and the various tissues retain their normal development. The muscles of the affected hip and limb are, perhaps, a little

thinner and softer than natural, but these changes are usually slight, and hence they often elude detection.

The symptoms now described may be regarded as, at least in some degree, characteristic of the first stage of hip-joint disease. Another train now succeeds, denotive of the steady advance of the morbid action, and equally significant of its presence.

The most prominent local phenomena, at this period, are, an increase of the pain in the hip and knee, flattening of the buttock, effacement of the gluteo-femoral crease, and apparent elongation of the limb, with spasmodic twitching and wasting of its muscles.

The pain, hitherto seated chiefly in the knee, now also affects the hip, or, if it existed there previously, as, indeed, is not unfrequently the case, it becomes sensibly aggravated. It is particularly violent at night, often for hours interrupting sleep, and attended with the most distressing spasmodic twitches of the muscles of the limb, which thus greatly augment the local and general suffering. The pain at one time is fixed, deep, aching, gnawing, or boring in its character; at another, erratic, sharp, or lancinating, darting about in different directions, now through the joint, then down the limb, and then through the groin, or back along the course of the sciatic nerve. Occasionally it is most severe in the lumbar region, in the lower part of the pelvis, in the situation of the acetabulum, or at the upper and inner part of the thigh. As before remarked, it is sometimes of a neuralgic character, coming, going, and recurring at particular periods. Derangement of the digestive apparatus, exposure to cold, and damp states of the atmosphere, have a tendency to aggravate and protract it. The pain in the knee, instead of disappearing, generally increases in violence, at the same time that it becomes more frequent and fixed.

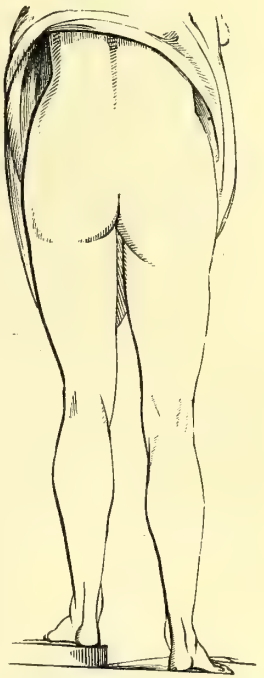
The sleep is habitually disturbed by unpleasant dreams, and the patient often wakes up in great alarm, crying and screaming, being perhaps much bewildered, and unable to determine where he is or what is the matter with him. Occasionally he is partially delirious, and some minutes may elapse before he regains his entire consciousness. He sleeps by snatches, and hence he usually feels fatigued and unrefreshed in the morning. Spasmodic twitching, jerking, or starting of the limb is a prominent symptom in this stage of the disease, and is rarely absent in any case. Sometimes, indeed, it sets in at a very early period, and continues, with more or less violence, during the whole progress of the malady. It is particularly distressing in the muscles of the thigh, but often affects those also of the hip and leg.

Along with these symptoms are frequently, but by no means constantly, impairment of the appetite, and disorder of the secretions, with a certain amount of fever at night. The bowels are usually inclined to be constipated, the urine is scanty and high-colored, the skin is rather arid, especially in the forepart of the night, and the patient is disposed to drink more than common. As the case progresses, the fever becomes more frequent and severe, and is often followed by copious sweats. The patient loses flesh and strength, he is peevish and irritable, and his countenance has a care-worn appearance. Although such is ordinarily the state of the system, in the second stage, especially

after the disease has made some progress, yet there are cases in which there is hardly any constitutional disturbance whatever, except what results from the loss of sleep.

The local phenomena (fig. 227) at this stage of the malady are unmistakable. The buttock of the affected side is found to be remarkably flattened, so as to be in striking contrast with the sound one. It is much broader, as well as considerably larger than in the natural state; the gluteal muscles are soft and flabby, and the skin is preternaturally loose, apparently from the absorption of the subcutaneous adipose substance. The gluteo-femoral crease, which forms so prominent a feature of this part of the body in the natural state, is completely effaced, giving the thigh and hip an appearance of continuity, or as if they were fused together. The muscles of the thigh and leg are also wasted, and this circumstance, together with the loss of fatty matter, imparts to the whole limb an aspect of attenuation, which, however, upon accurate admeasurement, is usually found to be much less than was at first supposed. The cause of this condition of the muscles is evidently twofold: want of exercise and perverted nervous action, leading to atrophy of their substance, as well as to the absorption of the subcutaneous and intermuscular fat. It certainly cannot be explained on the assumption of mere inactivity of the muscles, because an effect so conspicuous as this is never known to follow the want of exercise in a sound condition of the muscular fibre. Unfounded, however, as this explanation is, it is the one usually adopted by surgical writers.

Fig. 227.



Wasting of muscles shown, with elongation of limb, in disease of the hip-joint. The muscular deficiency is but imperfectly represented; the change of the ileo-femoral fold, resulting from it, is, however, sufficiently apparent.

Another remarkable circumstance noticeable in this stage of the disease is an elongated state of the limb, connected with the affected joint. So constant is this occurrence that it may, along with several of the other symptoms above described, be considered as pathognomonic. The extent of the elongation is indefinite, though, in general, it may be said to vary from half an inch to an inch and a half. In rare cases it may amount to two inches, and even two inches and a half. It is observed both in the erect and in the recumbent posture, but is commonly more conspicuous in the former than in the latter. Various explanations have been offered of this phenomenon, all, at first sight, more or less plausible. In the first place, it has been argued that it is owing to the presence of an unusual quantity of synovial fluid, the product of inflammatory action, by which the head of the thigh-bone is partially pressed out of its socket, and the corresponding limb projected beyond the level of

the sound one. No one, however, has yet verified this opinion by dissection. That there is an inordinate secretion of synovial liquor in this stage of the malady is highly probable, but that its quantity is generally so great as to cause such a result is hardly a supposable case. We do know that there are frequently large accumulations of this kind in other joints, as the elbow and knee, without producing such an effect. In the second place, the phenomenon has been ascribed to the relaxed condition of the ligaments and muscles of the joint; but of this occurrence, if it really exist, we have no more positive proof than of the influence which has been attributed to the synovial fluid. A third opinion, and, in my judgment, the only correct one, is that the elongation in question is occasioned by the difference in the level of the two hips, that of the affected side being always lower than that of the sound side. Now, a careful examination of the body will not fail to satisfy us that this difference is real, and not imaginary, and, moreover, that it is always in direct proportion to the increase in the length of the limb. Whatever mode of examination be adopted, the result will be the same, whether the patient be recumbent or erect. In the latter case, he is necessarily obliged to support himself upon the sound limb, which, for this purpose, he maintains in a state of rigid extension, at the same time throwing the corresponding hip somewhat outward, so as to bring the axis of the trunk on a line with the sound foot, and thus take off its weight from the affected extremity. This, it will be observed, hangs loosely from the pelvis, upon which the thigh is slightly flexed, while the leg is bent on the thigh, and the foot extended on the leg, the knee projecting prominently forward, much beyond the level of the opposite one, and the whole member resting upon the ball of the foot and toes. If this explanation be correct, as my experience warrants me in assuming, then the elongation of the limb, so constantly witnessed in this stage of the disease, is not real but imaginary, not positive but merely apparent.

Finally, there is generally, in this stage of hip-joint disease, a marked depression, or hollow, in the lumbar region, with a slight inclination of this portion of the spine toward the sound side, and an unusual prominence of the belly. The inferior portion of the spinal groove is also more distinct than natural.

In the third stage the nature of the disease is no longer doubtful, whatever it may have been previously. The symptoms are characteristic, being such as denote the extensive and frightful mischief that has been effected within the joint, in its several constituents. Matter now forms, and, by its pressure upon the inflamed structures, greatly aggravates the suffering. The existence of the suppurative process is indicated by an increase of pain; by a sense of throbbing and tension, deep and persistent; by severe swelling of the gluteal region, generally most prominent at the centre of the articulation; by œdema of the subcutaneous cellular tissue; and by a remarkably turgid and enlarged condition of the subcutaneous veins. The affected joint is intolerant of the slightest motion and manipulation, so much so, indeed, that the patient is unable to raise himself up or turn in bed without experiencing the greatest agony. Every attempt to move the limb is attended

with similar results. The constitutional disturbance is always in proportion to the local suffering, and violent rigors, followed by high fever and copious sweats, are rarely absent. Sometimes, however, the abscess forms in a quiet and insidious manner, without any of the severe symptoms that usually accompany the suppurative process in this and other varieties of inflammation. As the matter increases in quantity it gradually works its way toward the nearest surface, its approach being denoted by the occurrence of a circumscribed, erysipelatous blush. Here there is generally distinct fluctuation, and the parts, feeling soft and boggy, soon yield at one or more points, followed by the escape of the contents of the sac.

The site at which the matter, when left to itself, obtains a vent, varies in different cases. Most generally it escapes at the gluteal region, either immediately over the joint, or in its immediate vicinity. The other situations at which it is most liable to discharge itself are the upper and back part of the thigh, a short distance below the great trochanter, the superior and external part of the groin, the sacro-sciatic notch, and the upper and inner surface of the thigh. Occasionally it escapes at several points, either simultaneously or successively, leaving thus a number of orifices, leading to a corresponding number of sinuses. These passages are sometimes very long and tortuous, and in old cases they are always lined by a false membrane. Many years ago I saw an instance in which there were nine distinct openings, and very recently another in which there were as many as twelve; two at the upper part of the thigh, and one just below the crest of the ilium, the remainder being scattered over the gluteal region.

The matter sometimes escapes both externally and internally. In a case which I attended some years ago, the hip was pierced at several points, at the same time that the bottom of the acetabulum was so completely eroded as to permit the pus to pass into the rectum. Instead of draining off in this way, the fluid occasionally collects in a sort of pouch, between the inner surface of the iliac bone and the soft parts of the pelvis. In the female it has been known to escape by the vagina, and in both sexes by the bladder.

The matter in hip-joint disease is generally more fluid than ordinary pus, and also of a more greenish tinge. In fact, it very closely resembles the contents of a cold abscess, or the pus of a pulmonary cavern. It is often intermixed with small whitish particles, not unlike grains of soft boiled rice, with flakes of lymph, or even small clots of blood, especially when the antecedent inflammation has been unusually severe, or the parts have been roughly handled. More rarely it contains the debris of articular cartilage, ligamentous tissue, or osseous matter, in the form of little granules of a whitish, gritty character. Occasionally, though rarely, large pieces of bone are discharged, or, perhaps, even the greater portion of the head and neck of the femur. The pus, when long confined, is often very fetid, and it is always so when, in consequence of a perforating ulcer of the bowel, it is intermingled with fecal matter; very frequently, on the other hand, it is entirely free from odor. When an abscess of this kind has once fully

emptied itself, the subsequent discharge is often of a gleety character, ichorous, or thin and bloody.

The quantity of matter may be very small, or so abundant as gradually, but surely to exhaust the system. I have repeatedly seen cases where, at the first evacuation, upwards of a pint flowed off, and where, subsequently, the discharge amounted daily, for a number of weeks, to several ounces. At times the suppurative action is almost entirely suspended, perhaps for months, when, either suddenly or gradually, it reappears, and becomes as profuse as before. Once established, it has no special limit as to its duration. I have recently examined a case where the discharge has maintained itself, with hardly any interruption, for two years. The hip and thigh are covered with numerous scars, bearing evidence to the repeated formation of abscesses. The patient is a lad, aged fourteen, much stunted in his growth. Whenever the discharge is unusually protracted it may be assumed, as a general rule, that there is serious and obstinate caries of the bony structures of the joint, attended with the occasional escape of gritty substance.

The symptoms which accompany the discharge of matter are such, usually, as are denotive of hectic irritation. The patient, at least for a time, has regular vesperal exacerbations, the face is flushed, the pulse is excited, the sleep is impaired, and during the night the surface is drenched with copious sweats. Rapid emaciation ensues, the strength declines, and the bowels at length become harassed with colliquative diarrhœa. Thus life may be gradually worn out by exhaustion, or, the discharge diminishing, reaction may take place, followed, sometimes even in apparently desperate cases, by ultimate recovery.

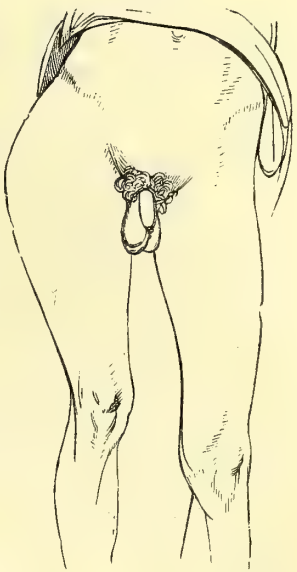
Suppuration, however, does not always take place in this stage of the complaint, or, if it do, the matter is either very small in quantity, or it is so soon absorbed as not to produce its characteristic symptoms. This is true, in many cases, even where the greatest ravages have followed the disease, as the complete disappearance of the articular cartilages, the round and cotyloid ligaments, and even a large portion of the head and neck of the thigh-bone.

It is seldom, according to my observation, that abscesses form externally to the joint in this disease without internal articular suppuration. Indeed, the occurrence is rare under any circumstances. During the progress, however, of the articular malady, the structures over and around the joint, participating in the inflammation, become hard and condensed from interstitial deposits, and from the same cause greatly enlarged in every direction.

The changes in the limb and hip in this stage of the disease are striking and characteristic (fig. 228). The extremity, now actually shorter than natural, is much attenuated from the wasting of its fatty and muscular tissues, and remarkably disfigured in its appearance, the heel being considerably elevated, and the ball of the foot and toes alone touching the ground when the patient makes an effort to stand. The degree of shortening is variable, and not always by any means in proportion to the destruction of the head and neck of the thigh-bone, the acetabulum, and the connecting ligaments, which forms so promi-

nent a feature of the disease at this period. While in some instances it does not exceed an inch, or, at most, an inch and a quarter, in others it amounts to twice and even thrice that extent. One-third, and sometimes even one-half of this, as I have satisfied myself by careful examination, is generally attributable to the elevation of the pelvis on the affected side. The position of the foot is variable. Sometimes it looks directly forwards, but most commonly it inclines inwards or outwards, the former direction being by far the more frequent. These differences are unquestionably due to the extent and nature of the ravages experienced by the hip-joint. When the acetabulum has suffered most severely, the foot usually inclines inwards, as in dislocation of the thigh-bone upwards upon the dorsal surface of the ilium; if, on the contrary, there has been much destruction of the head and neck of the thigh-bone, and the cotyloid cavity is only slightly involved, then the foot is generally everted, as in fracture of the neck of that bone, the external rotatory muscles tending to draw the whole limb in that direction.

Fig. 228.



Shortening, swelling, deformity, lameness; the advanced stage of coxalgia.

The thigh, as a general rule, is flexed upon the pelvis, the angle of flexion varying from the slightest perceptible change to 45°. In most cases it inclines somewhat towards the sound limb, and occasionally, though rarely, it overlaps or crosses it. Sometimes, on the other hand, it stands off widely and most unseemly from its fellow, as in the case of a woman, aged twenty-five, who was under my charge several years ago. In this case, the two knees are habitually upwards of fifteen inches apart; the affected limb sticks out in the most grotesque manner, and the foot, in the erect posture, is at least six inches from the floor.

The thigh, moreover, is always in a painfully rigid state, owing, probably, to two circumstances, the contracted condition of the muscles of the hip and limb, and the formation of adhesions between the remnants of the head and neck of the thigh-bone and the surrounding parts. By taking hold of the knee a slight degree of flexion may, perhaps, be produced, but to abduct the thigh, or to move it backwards, is generally impracticable; besides, every effort of the kind is ordinarily attended with excruciating suffering. Owing to the contraction of the hamstring muscles, the leg is commonly flexed on the thigh, and, for the same reason, the extensor muscles usually draw the heel upwards towards the leg.

The great trochanter generally lies directly over the acetabulum, or in its immediate vicinity, forming a hard, firm, immovable, or nearly

immovable, prominence, the nature of which it is not possible to mistake. In regard to the head and neck of the thigh-bone, they are, as was previously stated, usually completely annihilated, or so much wasted as to exist only in a rudimentary form. Much has been said by writers respecting the dislocation of this bone in this advanced stage of the disease; but generally in so vague a manner as to convey the impression that their statements are either entirely unfounded, or that they are based upon the assertions of others equally unentitled to credence. Few authors seem to have expressed an opinion upon the subject from personal observation. The valuable facts collected by Professor March, of Albany, in the extensive museums of the United States and of Europe, as well as in private practice, prove, most conclusively, that dislocation of the thigh-bone in any direction is exceedingly rare, as a consequence of this affection. A true luxation, such as occurs in the normal state of the parts, is, in fact, impossible, from the very nature of the morbid alterations experienced by the superior extremity of the bone in question, its head being generally completely destroyed, and its neck in great measure. Now, during the progress of the disease, this remnant of the neck, which is usually of a rounded conical shape, and frequently not more than three-quarters of an inch in length, if, indeed, so long, ordinarily places itself over the acetabulum, to the margins of which, and to the adjacent parts, it becomes, in the event of recovery, ultimately united. That it is occasionally drawn up beyond this point, especially when there has beeen complete destruction of the upper border of the acetabulum, backwards towards the sciatic notch, forwards upon the pubic bone, or downwards and forwards into the thyroid foramen, does not admit of doubt. Dislocation, however, in most of these directions can take place only in those cases where there has been extensive suppuration with separation or destruction of the soft parts, allowing the superior extremity of the bone to move about and thus seek, as it were, a new position. The upward displacement is, undoubtedly, the most frequent, but even this must be extremely rare. In one of my cases, the end of the thigh-bone projected above the acetabulum, where it had formed for itself a superficial socket in the iliac bone, admitting of very slight motion. The real cause, then, of shortening in the third stage of tuberculosis of the ileo-femoral articulation is not dislocation, as has been so often asserted, but the destruction, partial or complete, of the head and neck of the thigh-bone, along with a certain degree of elevation of the corresponding hip.

Diagnosis.—Although the symptoms of this disease are usually well-marked, especially after the lapse of some time, my observation satisfies me that it is extremely liable to be diagnosticated erroneously. The inexperienced practitioner, misled by the seat of the pain, too often contents himself with a most superficial examination, and, taking this as the basis of his therapeutic indications, is very apt to make a wrong application of his remedies, addressing them, perhaps, solely to the knee, which is only sympathetically involved, when they ought to be directed exclusively to the hip, the actual seat of the morbid action. Numerous cases, illustrative of the truth of this remark, have fallen

under my observation, and there are, I am sure, few surgeons in extensive practice who have not, like myself, had occasion to lament the great mischief that has thus been entailed. In a malady so grave as this an error of diagnosis may be fraught with the worst consequences both to the part and system, eventuating, as it necessarily must, in the loss of precious time; for it but too often happens that, when the true nature of the disease is discovered, all our efforts to arrest its progress are unavailing.

The affections with which this disease is most liable to be confounded, or which may, at least for a time, obscure its diagnosis, are sprains and rheumatism of the ileo-femoral articulation, psoas abscess, purulent collections in the vicinity of the hip and in the upper part of the thigh, and inflammation of the periosteum of the great trochanter.

A sprain, twist, or contusion of the hip-joint is not an infrequent occurrence, and may, if followed by considerable inflammation, give rise to severe pain and stiffness, seriously weakening the part, if not completely disqualifying it for the performance of its functions. The consequence is that the patient, in attempting to walk, raises the hip of the affected side and relaxes the corresponding limb, by bending the knee and retracting the heel, very much as in the earlier stages of tuberculosis. The muscles, also, by degrees become flabby and attenuated, and there is a sensible diminution of the temperature of the cutaneous surface. The gluteo-femoral crease is in time effaced, and even the general health may suffer. The signs of distinction are, the history of the case, the absence of pain in the knee, the greater latitude of motion, the absence, in general, of constitutional disturbance, and, lastly, the fact that the foot, although everted, is usually easily rotated on its axis, whereas, in strumous disease of the hip-joint, it is commonly pretty firmly fixed.

Rheumatism of the hip-joint, chronic and subacute, is generally caused by cold, or by sudden suppression of the cutaneous perspiration. It is seated principally in the ligamentous and synovial structures, the cartilaginous and osseous being seldom involved, except in very severe and protracted cases. The pain, which runs down the front of the thigh, is dull, heavy, or aching; the gait is limping; the pelvis is higher on the affected side than on the sound, and the limb exhibits, in the main, the same attitude as in lameness from sprains and contusions, with this peculiarity that the foot is always strongly everted, while in the former case it is generally inclined inwards. The patient in the morning complains of stiffness in the hip, which usually diminishes very sensibly after exercise, but is sure to return in the evening if there has been much exertion or fatigue. The muscles of the thigh are attenuated, but more firm than in tuberculosis, while those of the leg often retain their normal bulk; the gluteo-femoral fold is effaced; the limb, owing to the obliquity of the pelvis, is shorter, often from one to two inches, than natural; the great trochanter is uncommonly prominent; and a creaking noise is generally heard if the head of the thigh-bone be moved forcibly upon the acetabulum. Now, although these phenomena bear a very close resemblance to those of strumous disease of this articulation, yet the absence of severe

suffering at night, and at all times at the knee, the marked relief afforded by gentle exercise, the trifling annoyance from pressure, percussion, and motion, even when rudely performed, and the rare existence of rheumatism in children, together with the frequent coexistence of this disease in other parts of the body, will generally be sufficient to prove that the affection is not tubercular.

It is not often that psoas abscess can be mistaken for tubercular disease of the hip-joint; for, although the matter which is poured out in its latter stages, occasionally points at the outside of the groin, or at the upper and inner part of the thigh, there is always the most marked difference in the character of the two swellings, to say nothing of other symptoms. In psoas abscess the tumor is usually situated above Poupart's ligament, while in hip-joint disease it is commonly below; in the former it always sensibly diminishes and sometimes even entirely disappears under pressure, or when the patient lies down, but quickly reappears when the pressure is removed, or when the patient raises himself up; in the latter, on the contrary, it never changes its position, or, if it do, it is in consequence solely of the force of ulceration, absorption, and gravitation; in psoas abscess the swelling receives a distinct impulse on coughing, laughing, and crying, which is not the case in tuberculosis of the hip-joint.

Again, in psoas abscess, the principal pain is in the loins; it is fixed there, and is always greatly increased by the erect posture, as well as by every attempt to extend the corresponding limb. In hip-joint disease, the pain is most severe in the knee, or in the knee and hip. In psoas abscess there is at no period any change in the position of the great trochanter, nor any alteration in the length of the limb; in hip-joint disease, on the contrary, especially in its more advanced stages, these are prominent symptoms. Finally, psoas abscess occurs nearly always after puberty, whereas the other affection is most common in early childhood.

Sometimes large deposits of pus take place in the cellular tissue of the nates, or beneath the gluteal muscles, and, forming a prominent tumor in the direction of the ileo-femoral articulation, may thus simulate abscess of the hip-joint from tuberculosis. These accumulations are commonly the result of external injury, or of a phlegmonous, rheumatic, or erysipelatous state of the system, and are, therefore, in general easily distinguished by their history, by the rapidity of their progress, by the severity of the local distress, and by the comparatively prompt recovery of the parts after the evacuation of their contents. Cold abscesses of the nates, besides being exceedingly infrequent, exhibit none of the diagnostic signs of articular disease, especially such as pain in the knee, or pain in the hip-joint upon rotating the thigh, so characteristic of the latter malady. It is only when they depend upon caries of the innominate bone that the distinction would be likely to be attended with difficulty, and in this case a thorough exploration with the probe would probably furnish the requisite light.

Finally, diagnostic embarrassment, to an annoying extent, occasionally arises from periostitis of the great trochanter, in persons of a

rheumatic or gouty habit of body. The fibrous membrane of this portion of the femur becomes exquisitely painful and tender to the touch, under the slightest motion and percussion, and the disease, extending above the neck of the bone and capsular ligament of the joint, causes distress and difficulty in walking, with elevation of the corresponding side of the pelvis, similar to what is seen in coxalgia. The soft parts around are swollen and puffy, giving the hip an increased breadth and thickness; by and by suppuration takes place, sinuses form, and small portions of the bone separate and come away. Unless the case be well managed the joint becomes stiff, and the patient does not regain his health for a long time. The signs of distinction are the persistence of the gluteo-femoral crease, the coexistence of rheumatism or gout in other regions, and the fact that the disease usually occurs later in life than coxalgia.

But it is chiefly in the very early stages of this affection that erroneous views of its diagnosis are liable to be formed; when it is fully established, the phenomena are generally too well marked to be mistaken. It has been seen that the very first symptom, in every case, is pain in the knee; so uniform and constant, indeed, is this occurrence that it must be regarded as pathognomonic, and yet, as was previously stated, it rarely happens that it is referred to its true source. Instead of being considered as an expression of disease of the hip-joint, it is too often regarded merely as an effect of neuralgia, rheumatism, or injury of the knee, to which, accordingly, the treatment is exclusively directed. Its great value, as a diagnostic, is totally overlooked, and thus the disease is allowed to progress, at the only time almost when it admits of prompt and radical cure.

In order to avoid this serious and too common mistake, a most thorough examination should be made in every case presenting the slightest suspicion of the existence of tuberculosis of the hip-joint. The very fact that there is pain in the knee, severe in degree, and of frequent recurrence, should of itself excite the alarm of the surgeon; but especially should he be on his guard if, added to this, there is a limping in the gait, an increase of suffering after slight exercise, and disturbed sleep at night. If the diagnosis is obscure, the examination must be repeated, again and again, until it is perfectly cleared up. To conduct the investigation properly the patient must be completely stripped, and viewed both behind and in front, as he stands on the floor. If there be any flattening of the nates, unusual prominence of the trochanter, or change in the gluteo-femoral fold, it will be sure to be detected, and so, also, if there be any alteration in the attitude, size, or length of the corresponding limb. If the patient be now requested to walk, the amount of limping will be discovered, as well as the manner in which he raises and moves the leg and foot. To complete the investigation, the patient is now stretched out on the floor, or on a hard lounge, with a view of ascertaining the amount of suffering produced by rotating the head of the thigh-bone upon the acetabulum, and also by bringing these parts forcibly into contact with each other by percussing the knee, the leg being flexed, or the sole of the foot opposite the ankle, the foot being bent on the leg. The patient being

next turned upon his abdomen, the hip is thoroughly examined, first, with reference to the condition of its soft parts, and, secondly, with relation to the sensibility of the component structures of the joint; finally, if there be any obliquity of the pelvis it may easily be observed both in the erect and in the recumbent posture; and any change in the length of the affected limb may be determined by extending a piece of tape, or other suitable band, from the anterior-superior spine of the ilium to the inner side of the lower extremity of the patella. The difference in the length of the measure on the two sides will give the difference in the length of the thighs, or the distance between the hip and knee-joints. The use of chloroform will often be of great service in conducting the movements of the limb while the patient is recumbent, especially when the parts are very painful and intolerant of manipulation.

Morbid Anatomy and Pathology.—The morbid changes induced by this disease vary, as might be supposed, according to the different stages of its progress. As it never proves fatal in its incipiency, all that we know of these changes at this period has been learned accidentally, by examining the bodies of those who have died of other maladies. Enough, however, has been ascertained to show that they do not differ materially, if any, from those of ordinary inflammation. The synovial membrane, which is commonly first implicated in the morbid action, affords evidence of slight vascularity, a few delicate, straggling vessels, loaded with blood, being observable upon its surface, and, in most cases, it is somewhat opaque and softened, not uniformly, but at certain points. An appearance of thickening is often imparted to it, from a deposition of lymph, which, occurring even quite early in the disease, soon assumes a pulpy consistence and a pale-yellowish color, though occasionally it verges upon greenish. Sometimes it is shreddy, tomentose, or filamentous. The articular cartilage, if seriously involved in the inflammation, is of a dull whitish, or slightly grayish aspect, and somewhat thickened and softened, if not partially separated from its osseous connections. The cancellated structure of the bones is abnormally vascular, light, porous, and humid, being at the same time easily broken and cut. Not unfrequently its cells are distended with yellowish tubercular matter, of a semi-solid caseous consistence; or, this substance presents itself in the form of distinct masses, free or encysted, and, perhaps, not larger than a millet-seed. However this may be, these changes are always more conspicuous in the head and neck of the thigh-bone than in the innominate bone, which is seldom seriously affected at this stage of the disease. The round ligament usually suffers early, being abnormally red, tumefied, and softened. The synovial fluid is generally increased in quantity, but rarely to any considerable extent.

As the malady advances, the alterations above described become more distinctly defined; the disorganizing process being now in full play, its devastating effects are plainly visible in every portion of the joint. The lymph gradually increases in quantity, and is often intermixed with a little sero-purulent matter, or thick greenish-looking pus. The synovial membrane is partially destroyed, and what remains is of

an opaque, muddy, and ragged appearance. The cartilage is ulcerated, pulpified, discolored, perforated, and almost completely detached. The bony structure is very red, soft, carious, rough, and easily crumbled. The round ligament is in a great degree destroyed, while the capsular ligament, as well as the cotyloid, exhibits well-marked signs of inflammation, being loose and spongy at one point, attenuated at another, and perhaps thickened or hypertrophied at a third.

The disease having reached its acme, the structures of the joint are completely subverted, with hardly any traces of their original appearances. Pus is now usually seen—often, indeed, in large quantity—with all the qualities of strumous matter. This, however, is not always the case; for, at times, it is thick and pultaceous, caseous, ichorous, or sero-sanguinolent. In one instance, observed not long ago, I found it very thin, and almost black, evidently from the effects of the necrosed condition of the hip-bone. The synovial membrane, the round ligament, the articular cartilages, and the head and neck of the thigh-bone, with the margins, and frequently, also, the bottom of the acetabulum, are partially destroyed, if not completely annihilated. In the more severe cases the cotyloid, the transverse, and even the capsular ligament are entirely absorbed, the surrounding parts are extensively separated by the ulcerative and suppurative processes, numerous fistulous openings exist, and the gluteal muscles are transformed into dense, firm bodies, of a pale-reddish, yellowish, or whitish color. Cases are not wanting, especially when the disease is of long standing, in which these muscles undergo the fatty degeneration. Occasionally both trochanters are absorbed; or there is extensive caries of the innominate bone; or the head and neck of the thigh-bone are necrosed; or the joint contains numerous fragments of bone and cartilage; or, the bottom of the acetabulum being perforated, the matter extends into the pelvis, and passes off by the rectum. In children, prior to the completion of the ossific process, the hip-bone has been found separated, at the acetabulum, into its three primitive pieces.

The head and neck of the thigh-bone being absorbed, the remnant of the superior extremity of this bone usually lies across the acetabulum, or in its immediate vicinity. Occasionally it is drawn up a little beyond this cavity, against the surface of the ilium, resting in a slight depression, which, however, bears only a very faint resemblance to a new socket. A few instances, and but a few, have been observed, in which it was found, on dissection, forced backward into the sciatic notch, forward upon the pubic bone, or downward into the thyroid foramen. When the disease has expended itself mainly upon the acetabulum, the head of the thigh-bone may remain in its original position; or it may even pass—as, in fact, it has been known to do in several cases—into the pelvis.

If death takes place after a process of recovery has been set up, the acetabulum will be found filled by a white, fibrous, organized substance, the extremity of the thigh-bone being anchylosed, or firmly attached by new matter to the surrounding structures. It is very rare for a new socket to be formed; yet that this is not impossible is proved by dissection, as well as by specimens in different museums. In time the

artificial joint may admit of considerable motion, as is seen in persons who have recovered from the disease, attended with great shortening of the limb; but, in general, the motion is extremely restricted. Sometimes an imperfect ligament is formed round the bony knob above described, and the surface of this bony knob may even become slightly tipped with cartilage. Finally, osseous growths—short, irregular, and friable—occasionally make their appearance upon the thigh-bone, and also upon the innominate bone, in the vicinity of the former disease.

The bodies of those who die of strumous disease of the hip-joint, or while laboring under this affection, usually exhibit serious pathological changes in some of the internal organs. These changes appear to be the direct result of the tubercular cachexia, which is generally so well marked in the latter stages of the local malady, and they exist in various forms and degrees in different structures. The most common are tubercular deposits and dropsical effusions, which are rarely entirely absent in any case, especially if of long standing.

Tubercles of the lungs are very common; they often exist in great numbers, especially in the summits of these organs, and they always exhibit the same characters as in ordinary phthisis. Cavities sometimes form, but death usually occurs before they attain any considerable magnitude. The bronchial ganglions commonly participate in the pulmonary disease, being enlarged and tuberculized. Occasionally extensive adhesions are found between the lung and costal pleura, with or without serous and other effusions. The heart is seldom affected.

The peritoneum is sometimes extensively tuberculized, and considerable quantities of water are often found in its cavity. In children, the lymphatic ganglions of the pelvis and mesentery are apt to suffer from strumous deposits, and similar changes are occasionally witnessed in the spleen. The liver is often cirrhosed and hypertrophied. Now and then the glands of Peyer suffer. In one of my cases, they were quite extensively ulcerated. The pancreas, stomach, and genito-urinary organs are usually sound. The rectum, and even the colon, the vagina, and the bladder, are sometimes found perforated, the matter passing directly from the hip-joint through the abnormal aperture. The blood is generally very thin, and deficient in fibrin and coloring matter. The lower extremities, and even the hands, face, and genital organs are, at times, anasarcous, especially when the system has been worn out by tubercular disease of different parts of the body.

Tuberculosis of the hip-joint, as the name correctly implies, is essentially a scrofulous disease, bearing the same relation to the structures of that articulation that phthisis bears to the lungs; in other words, it is, to use a common but sufficiently expressive phrase, like scrofolous complaints in general, merely a local symptom of a constitutional disorder. Take away this constitutional vice, this strumous cachexia, and in either case no local disease can arise. That this is not a mere assumption, but an indisputable fact, is abundantly established by the symptoms and progress of the local affection, and by the appearances revealed on the dissection of those who die of it.

Tubercular disease of an organ does not necessarily suppose in that organ the existence of tubercular deposits. In strumous corneitis, for

example, we find nothing of the kind, and yet no one, at all familiar with the character of that malady, would deny it such a parentage. In certain diseases of the skin there is undoubtedly scrofulous action, without, so far as can be determined, any secretion of tubercular matter. When the disease begins in the synovial membrane of the hip-joint, it probably deports itself in the same manner as when it invades the tunics of the eye; and the same thing, there is reason to conclude, occurs when it takes its rise in the cartilaginous tissues. When, on the contrary, it commences in the osseous structures, whether in the femur or in the innominate bone, there may, and no doubt often is, a genuine deposit of this kind, such as is so frequently met with in the short bones, as those of the spine and foot, and also in the articular extremities of some of the long bones. Such, then, it is believed, is the true pathology of this affection; but to enter into any further discussion here would be to describe the pathology of strumous affections in general, for which this is not the proper occasion.

Prognosis.—Tuberculosis of the hip-joint is essentially a chronic disease, which, after having endured for an indefinite period, terminates either in recovery or in death. The recovery may be complete, both as it regards the part and system, or, the local action disappearing, the joint may be left weak and anchylosed, and the general health regain its original vigor; or, as not unfrequently happens, particularly after the process of disorganization has commenced, both the articulation and the constitution may remain in a degraded and crippled condition for a long time, if not during the rest of life. No mortuary statistics of this affection have yet been furnished, and it is, therefore, impossible to state, with any degree of precision, the mean duration of fatal cases, or the relative proportion of deaths to recoveries. My opinion, founded upon numerous observations, is, that the mortality from the disease is slight in almost any event, even when there has been palpable neglect in regard to treatment, medical, surgical, and hygienic. In this view, I believe, most writers fully concur. When death does take place, it rarely happens before the eighteenth month, and very often not until after the second year.

Much of the mortality of this disease, as well as most of the bad effects, both temporary and permanent, which it entails upon the affected articulation, results from neglect of appropriate management, prior to the commencement of the disorganizing process. Properly treated at its beginning, it is, at least in the majority of cases, as amenable to our remedial agents as any ordinary chronic inflammation, although not generally so promptly. The morbid action gradually receding, the effused materials are by degrees absorbed, and the parts restored to their normal functions. Arrived at its second stage, hardly any course of medication, however judiciously applied, will completely avert permanent rigidity, although life may not be at all in jeopardy. The morbid impression has already advanced too far to admit of easy recession; a certain amount of organic lesion is present, and the patient may congratulate himself if he ever completely regains the use of his hip. In the third stage, when the osseous, cartilaginous, and other structures are disintegrated and broken down; when, perhaps, the

interior of the joint is converted into a large chronic abscess; when the lower extremity is shortened and stiffened, and, finally, when the constitution is worn out by pain and hectic irritation; there will not only inevitably be loss of function, but also danger of loss of life. If, under such circumstances, the patient survive, his recovery will be effected at the expense of much suffering, too often eventuating in premature decay and dissolution.

Treatment.—In the treatment of this affection, which, if our notions of its pathology be well founded, is, like scrofulous disease in general, merely a local manifestation of a constitutional vice, topical remedies alone will not avail; to prove efficient and truly useful they must be combined with, and aided by, means addressed to the general system with a view to the improvement both of the solids and fluids. It would be idle, in the present state of the science, to insist upon a course so palpably proper in itself, and so long sanctioned by experience. As well might the practitioner expect to be able to cure consumption, or to ameliorate the condition of a person thus affected by the exclusive employment of counter-irritation and other external measures, as to cure tuberculosis of the hip-joint without the aid of constitutional remedies. Again, in treating this disease it should not be forgotten that it consists of different stages, which, although they run into each other by imperceptible gradations, are nevertheless of vast importance in a practical point of view.

Whatever may have been the duration of the malady when the treatment is commenced, the first and most essential element in the management of every case of the kind is repose, not merely of the limb, but also of the body; repose absolute, unconditional, and persistent. Upon this subject there must be no compromise between the patient and his attendant. The contract entered into at their first interview must be observed with the most scrupulous fidelity; it must be both binding and permanent. The slightest departure from this injunction would in any stage of the complaint be of great detriment to the patient's limb, while in its more advanced stage, when the bones and cartilages are destroyed and matter exists in the joint, it might seriously jeopard his life. Recumbency must be observed for months upon months. Too much stress cannot be placed upon this point, when it is remembered how important it is to keep parts, comparatively insignificant, perfectly at rest when in a state of suffering. In inflammation of the fingers and toes repose and elevation of the affected structures are instinctively sought, and, if possible, maintained, until the morbid action has in a great degree subsided and function been restored. Now, if this be necessary in ordinary inflammation and in textures which have no important uses and sympathies, how much more necessary is it when the malady is of a specific nature and the organ involved is so important as that of the hip-joint? These facts are well known to practitioners, but the common people are ignorant of them, and hence they should always be thoroughly explained to the patient and his friends at the very threshold of the treatment.

In order to render the patient as comfortable as possible, and enable him to endure his protracted confinement without detriment or incon-

venience, he must be furnished with a suitable bed provided with slats and a firm but elastic mattress. A common trundle-bed, about four feet in width, will answer every purpose, and is in every respect preferable to the common bed, especially if the patient is a child, as he will thus be less liable, if he should roll out, to hurt himself. The sheet should be well secured at the sides that it may not become rumpled, and the pillow should be of medium size, so that, while it affords adequate support to the head and shoulders, no undue weight may be thrown upon the trunk and pelvis. The confinement, if rigidly insisted upon, will not prove irksome; with the aid of toys and other sources of amusement the little patient will soon—often, indeed, in a few days—become completely reconciled to his new mode of life.

The local remedies must be regulated by the progress of the malady and the constitution of the patient. If the disease be in its first stage, if the pain be violent and frequent in its recurrence, and if the general health remain unimpaired, we can scarcely fail to derive special benefit from the application of leeches, or, in their absence, from the use of a large blister. The leeches should be scattered over the affected joint, and after they have dropped off, the flow of blood should be promoted for some time with cloths wrung out of warm water and frequently renewed. Their number must depend upon circumstances, but in general from six to eight will be sufficient for a child from three to six years of age. Sometimes a blister may be applied advantageously within a few days after the leeching, and I much prefer this mode of counter-irritation to the employment of liniments, embrocations, croton oil, tartar-emetic ointment, and iodinized lotions, which is always attended with friction, and for that reason often prejudicial to the inflamed structures. By these means, aided by a plain, simple diet, consisting mainly of farinaceous articles, with milk, weak tea, or milk and water, at breakfast and supper, and an occasional purgative of from two to three grains of blue mass with double that quantity of jalap, most of the cases that are brought under the notice of the practitioner may be radically cured in a few months. If fever be present, or if there be decided plethora, as denoted by the state of the pulse and face, the antimonial and saline mixture may be given in such doses and at such intervals as the nature of the case may seem to require. When the pain is so severe as to interrupt sleep, opiates must be used with warm anodyne poultices or fomentations, or, what I have found to be of greater benefit, a lotion composed of three parts of soap liniment and one of acetated tincture of opium with from half a drachm to a drachm of carbonate of potassa to the ounce, applied by means of a fold of flannel, kept constantly wet, and covered with gutta-percha. Cold applications are generally inadmissible both in this and in the other stages of the disease. When the skin is unusually dry, or the system more than commonly irritable, the warm bath, for half an hour at a time, with a Dover's powder at night, is sometimes highly beneficial, but great care must be used in its administration lest the affected joint sustain injury.

Such is an outline of the treatment which, according to my experience, will usually be found most serviceable in the earlier stages of

the complaint. There is, however, not a little diversity in regard to the nature of the internal remedies required in different cases. As already stated, there are two distinct classes of patients, the plethoric and the anemic, those with an apparently rich blood and those with an impoverished blood; and hence two very opposite courses of treatment are frequently necessary, the former demanding perhaps a certain amount of depletion, while the latter will be most benefited by tonics. I have not met with any cases where I thought the use of the lancet was indicated, and yet I am not prepared to say whether, when the inflammation and pain are very great, in a strong, robust child, soon after the commencement of the malady, venesection, to a small extent, might not be highly beneficial, tending to retard the suppurative crisis, and to prevent the destruction of the osseous and cartilaginous tissues; in general, however, the remedy would be too harsh, and I am satisfied that the morbid action may be sufficiently repressed by the antimonial and saline mixture, in union with a minute quantity of tincture of aconite, assisted perhaps by the application of a few leeches to the seat of the disease. In the anemic, a not uncommon class of cases, tonics and stimulants are often required at the very commencement of the disease; consisting either of quinine and iron, or, what is peculiarly valuable under such circumstances, cod-liver oil, in such doses as shall not prove offensive to the stomach. The diet should of course be of a corresponding character, and the patient should, if possible, be induced to use milk-punch, wine, ale, or porter, in order to rebuild the system, and thus enable the affected parts the more effectually to resist the encroachments of the morbid action.

I am not, as a general rule, an advocate for confining the affected limb in splints, as is the custom of many practitioners, with a view of securing more perfect rest of the joint. The patient himself will usually instinctively take care of this. It is only, or chiefly, when the limb is much out of shape, or in a position in which, if permanently retained, its usefulness would be seriously impaired, that I have found such a procedure either necessary or desirable. The restraint occasioned by all such contrivances is generally exceedingly irksome to the child, and is often, I am sure, productive of harm instead of benefit. When the malposition of the extremity is considerable, the first thing to be done, provided there is as yet no great structural lesion, is to rectify this by extension and counter-extension, aided, if necessary, by rotation and abduction, the patient being under the influence of chloroform, and then to apply a suitable apparatus for maintaining the limb in its new relations. The best materials are gutta-percha, undressed sole-leather, or trunk-maker's board, soaked in hot water, adapted to the hip, thigh and leg, and kept in place by a common roller. When dry, these articles form an admirable case, which may afterwards be padded with cotton to ward off pressure, and which will thus effectually prevent motion, not only of the hip, but also of the knee and ankle.

The attempts at rectifying the malposition of the limb are occasionally annoyingly counteracted by the contraction of the principal

adductor muscles of the thigh, especially the pectineal and short adductor, which are sometimes so much shortened as to draw the extremity nearly across the sound one. When this is the case, the most expeditious plan is to divide these muscles subcutaneously; and the effect of such an operation upon the future welfare of the part and system is often most striking, the pain and spasm being relieved as if by magic, and the limb becoming perfectly docile and manageable.

In the second stage of the affection, the only reliable local remedy, according to my experience, is a large issue, for the purpose of securing a free and permanent discharge of matter. If the case have not been seen before it has reached this crisis, some of the means already mentioned, as leeching and blistering, may be tried; but, unless they are promptly beneficial, no time should be wasted in their employment. The disease is now thoroughly established, and must be met in the most decisive manner, if we would wish to avoid its disorganizing and destructive consequences. The best place for making the issue is the most prominent part of the swelling, which is usually either directly over the joint or in its immediate vicinity. It is reasonable, *a priori*, to suppose that the nearer the discharge is established to the diseased structure, the more likely will it be to be useful; and this is precisely what experience has shown to be the fact. The place of election, then, is a circumstance of great importance, and should not be overlooked.

The most eligible form of issue is that made with the actual cautery. The patient being under the influence of an anæsthetic, the iron, heated to whiteness, is gently pressed upon the part until a suitable eschar has been formed; one about the size of a twenty-five cent piece, if the patient be very young, or twice that size, if he be twelve or fifteen years old. The slough, which should not extend beyond the subcutaneous cellular tissue, will generally drop off within the week; and, during this period, as well as afterwards, the parts should be kept constantly covered with a linseed poultice, renewed several times in the twenty-four hours. The discharge, if flagging, may be promoted by savine ointment, by simple cerate, containing a few drops of nitric acid to the ounce, or, what I prefer, the occasional application, for a few hours, of a small blister. In this manner, I have known an abundant pyogenic discharge to be maintained for the greater part of a year. The cautery may, if necessary, be reapplied at any time during the progress of the treatment.

I give the hot iron a decided preference, for making an issue in this disease, to all other modes of cauterization, as affording not only a more copious and persistent flow of pus, but, what is of no little importance, making a much stronger, as well as a more permanent, impression upon the part and system. It is impossible always to determine how long the suppurative action should be kept up; but it will be found to be a good rule to let it continue until there is reason to believe that the morbid process, for the relief of which it was instituted, has completely subsided. I have never, in any instance, experienced any bad effects from its protracted continuance; indeed, quite the contrary has been the case. If the discharge becomes offensive, as it often does in warm weather, or where proper attention to

cleanliness is not observed, the chlorides will come in play, with a more frequent change of dressings. Occasionally the linseed poultice oppresses by its weight, or causes painful and itchy eruptions around the sore; when this happens it must be temporarily suspended, or be replaced by some more suitable application.

Independently of the advantages here alluded to, as being afforded by the issue made with the hot iron, there is another of nearly equal, if not, indeed, greater value. I allude to the fact that it may be used most efficiently for the local application of morphia, not so much for inducing sleep, as with a view of allaying the excessive pain of the parts, and the spasmodic jerkings of the muscles of the limb. Employed in this wise it acts, according to my observation, much more promptly and energetically than when administered by the mouth. The quantity necessary to produce the desired effect will, of course, depend upon circumstances; but, in general, from half a grain to a grain will be required for a child three or four years old. Sometimes an injection of laudanum, or an opiate suppository, will allay the pain and quiet the system more effectually than anything else.

In regard to the patient's diet, in this stage of the disease, the same rules should govern us as in the preceding stage; but it should, if possible, be somewhat more restricted, especially if there be much pain, with occasional fever. The bowels should also be maintained in an active condition, the best general purgative being a few grains of blue mass, with a suitable quantity of jalap, or the compound calomel pill. Salines and nauseants will rarely be required. If the patient labors under symptoms of debility, as denoted by the pallor of his countenance, the coldness of the extremities, and the disorder of the digestive organs, tonics, especially quinine and iron, should be employed, along with a more generous diet and nutritious drinks.

In the third stage, characterized by serious structural lesion, and the formation of matter, the treatment will require to be essentially modified, to meet the local and constitutional contingencies. Prior to this period, it was, if not decidedly antiphlogistic, at all events rather of a depressing character, intended to subjugate inflammation and establish resolution; now that the morbid action has gained the ascendency, and exhausted both part and system, a widely different course is demanded.

Two most important indications are presented, in almost every case, at this stage of the complaint. The first is to limit the suppurative process; the second, to promote the speedy absorption of the effused fluid. To fulfil either is generally no easy task; for experience has proved that there are few cases in which our efforts, however skilfully conducted, are crowned with success. When the suppurative process declares itself by well-marked symptoms, as rigors, alternating with flushes of heat, and followed by copious sweats, something may be done to moderate its violence by the steady and energetic use of antiphlogistics; but, in general, it will be found that the patient is either too feeble to justify their employment, or that the disease has been so insidious in its approaches as to defy recognition before the mischief has been completed. It has been seen, however, that matter does not

always attend this stage, and that when it does, it often exists only in small quantity. Now it is in the latter class of cases, more particularly, and in those where the suppurative process can be carefully watched from its very inception, that strenuous and persistent efforts should be made to prevent the accumulation, with its concomitant mischief. For this purpose the affected hip should be painted at least twice a day with some sorbefacient lotion, such as equal parts of tincture of iodine and alcohol, or a weak solution of iodine and iodide of potassium, care being taken that, while applying it efficiently, it is not put on so freely as to cause pain or irritation beyond a few minutes. The object should be merely to excite the absorbents, the capillaries being fully kept in abeyance; otherwise injury, not benefit, will be likely to result. Sometimes a large blister answers a good purpose; retained just sufficiently long to produce slight vesication, and repeated every four or five days for several successive weeks. Thorough or protracted vesication is to be avoided, as likely to prove detrimental, from its irritating effects, both upon the part and system. If the disease has not yet advanced too far, if the abscess is still small, and, above all, if the suppurative process be attended with great pain and constitutional disturbance, I know of no remedy so well calculated to fulfil the present indication as the actual cautery, applied in such a manner as to produce a broad but superficial issue. My experience is that, even in this stage of the malady, when everything is apparently most unpromising, more benefit will, in general, accrue from this mode of counter-irritation than from any other with which we are acquainted. It will not only, in many cases, promote the absorption of the pus that is already effused, but materially curtail the suppurative process, and at the same time greatly ameliorate the local distress. If the accumulation be very large, the remedy must, of course, be dispensed with, and artificial evacuation encouraged.

Along with the local remedies just pointed out, should be used certain internal means, to aid and expedite their sorbefacient action. At the head of the list may be placed mercury, especially the iodide and bichloride, administered in small quantities several times a day, and properly guarded by opium, to prevent them from griping and purging; the iodide of potassium and Lugol's solution are also valuable remedies. Ptyalism is of course avoided, and the strength is sustained with tonics, a generous diet, and nutritious drinks.

If these means fail, or if the abscess be already very large when we are called to the case, the matter should be evacuated artificially. I am aware that, upon this subject, there is generally a great deal of repugnance evinced by practitioners, on the supposition that any interference of this kind will only tend to aggravate the local disease, and cause hectic irritation. To such a view, however, I cannot subscribe. On the contrary, I can see no just reason why the general rules of surgery should be departed from in this disease any more than in others. It is well known that matter, wherever and whenever existing in large quantity, invariably does harm; for, not only is it apt to burrow extensively among the surrounding parts, but it must necessarily, by the pressure which it exerts upon the inflamed surfaces

with which it is in contact, increase the pain, and effectually prevent the restorative process. That this is the case in regard to extensive purulent collections generally is a fact so well established as to require no argument in its support, and if there be any exceptions respecting such accumulations in the hip-joint I am not aware of them. My conviction is that practitioners, influenced by the dogmas of the schools rather than by their personal experience and the dictates of common sense, have seriously erred in their treatment of strumous abscess of the ileo-femoral articulation, and been thus directly instrumental in the production of much mischief. In their endeavor to avoid too early an outlet, they have too frequently allowed themselves to wander into the opposite extreme, and neglected to make an opening at all: in other words, in attempting to steer clear of Scylla they have unwittingly rushed into Charybdis. The proper plan, undoubtedly, is, in all cases where the absorption of the matter is no longer a probable event, to promote its escape by the knife. It is the one which, as stated elsewhere, I have invariably pursued in all joint diseases for upwards of twenty years, and in no instance have I seen any reason to regret it. In this manner vast suffering is avoided, as well as much structural lesion prevented, as is abundantly shown by the numerous and tortuous sinuses which so frequently form in the hip when the disease is left to its own course. The artificial opening, however, is not to be made heedlessly, or without due attention to the permanent exclusion of the air, which, although in itself innocuous, often proves pernicious, from its tendency, when brought in contact with the pent-up fluids, to favor decomposition, and, consequently, the development of hectic irritation. These effects may generally be prevented by giving the opening a valvular form, as in evacuating chronic abscesses in other situations, by making a puncture rather than an incision, and by closing the orifice, immediately after the operation, with adhesive strips, supported by a light compress and bandage. If the quantity of matter be unusually large, a portion only should be drawn off at a time, the process being repeated in a few days until the whole is removed; but ordinarily the sac may be emptied advantageously at the first operation.

As soon as the fluid has been evacuated, whether partially or completely, a full opiate should be administered, in order to prevent undue reaction; and if the joint becomes painful, anodyne fomentations should be used, until relief is afforded. Afterwards, with a view of moderating suppuration, the parts are painted regularly once a day with some sorbefacient lotion, a linseed poultice or the warm water-dressing being used as the permanent application.

If sinuses form, whether as a result of spontaneous or artificial evacuation, the best plan is not to interfere with them, as the pain and loss of blood consequent upon the employment of the knife would more than counterbalance any good effects from the operation. If loose fragments of bone, or pieces of cartilage, present themselves, they should, of course, be promptly extracted.

The violence of the suppurative action having been subdued, the plastic deposits are best dealt with by sorbefacient plasters, applied so

as to embrace the whole of the affected surface, and steadily worn for many weeks. Of these plasters, the most useful, for this purpose, is the ammoniac and mercurial, under the influence of which the induration and swelling often disappear with astonishing rapidity. If much pain be present, a suitable quantity of morphia, opium, or cicuta may be incorporated with its ingredients.

During the latter part of this stage, tonics and stimulants are usually indicated, and often imperatively demanded, by the exhausted state of the system. The patient, emaciated and anemic, must be supported with quinine and iron, cod-liver oil, a generous diet, and nutritious drinks, as milk-punch, wine-whey, ale, or porter. If night-sweats be present, the most suitable remedy will be the aromatic sulphuric acid, either alone or in union with Huxham's tincture of bark. Diarrhœa and pain must be checked with opiates. The patient's apartment should be frequently ventilated, and the surface of the body should be daily washed with tepid salt-water, followed by dry frictions. Exercise in the open air is now generally of much service, and may often be taken by the little patient himself, seated in a go-car, and propelled gently round the yard, or over a smooth road. Carrying him about in the arms is highly objectionable, on account of its tendency to hurt the joint, by pressing the affected limb. In a word, nothing should be omitted that may, in the slightest degree, tend to invigorate the system and improve the health.

When the extremity of the thigh-bone is necrosed, or so completely carious as to forbid all hope of recovery by time and ordinary means, the soft parts being riddled with sinuses, and the discharge copious and exhausting, excision of the diseased parts will be demanded, and should, if life be not too far exhausted, be promptly executed, as most likely to rescue the patient from impending death. The object of the undertaking, of course, is to remove all the ulcerated structures, and hence the surgeon, after having exposed the joint, should not limit himself merely to the thigh-bone, but perform a similar operation, if necessary, upon the margin and bottom of the acetabulum. The disease being thus arrested, the part and system will be placed in a much better condition for gradual and permanent recovery, provided the shock of the operation is not so severe as to destroy life, either immediately or consecutively. With proper care after the excision, it may even be possible to preserve a certain degree of motion between the contiguous bones. In an interesting and instructive paper on "Excision of the Head of the Femur, and Removal of the Upper Rim of the Acetabulum, for Morbus Coxarius," by Dr. Lewis Sayre, of New York, an analysis of thirty cases, including one by himself, is given, of which twenty recovered and ten died, four of them within one week after the operation. It would thus appear that excision of this joint is by no means devoid of danger, although the mortality is much less than after amputation of the hip-joint. The statistics of Dr. Sayre have recently been extended by Dr. R. A. Kinloch, of Charleston, South Carolina, with no material variation, however, as to the results. In the case operated upon by himself, death occurred in less than thirty hours, from exhaustion.

The operation may be conveniently performed by making a curved incision, from five to six inches in length, perpendicularly over the joint, in a line with the great trochanter, separating the parts, and cutting off the diseased structures with the saw or pliers. If more room be required, the incision may be crucial, or in the form of a T or V. The flaps are afterwards approximated with stitches and plasters, and the immobility of the limb is secured by appropriate splints, pads, and bandages, as in fracture of the thigh-bone.

When the patient has been exhausted by protracted suffering, and life is fast ebbing away, it has been proposed, as a dernier resort, to amputate at the hip joint; and the records of surgery contain several examples, among others, one by Dr. Duffie, of this city, in which the operation has been followed by the most gratifying results. Nevertheless, I should hesitate before undertaking so grave a procedure, the more especially as the same end may generally be more readily attained by the more simple and less dangerous operation of excision.

SECT. VII.—CHRONIC RHEUMATIC ARTHRITIS.

The joints are liable to a peculiar form of disease, known under the name of chronic articular rheumatism, or chronic rheumatic arthritis, observed chiefly in elderly and middle-aged subjects among the laboring classes, though occasionally it also occurs in the higher orders of society, in particular among the indolent and habitually intemperate in eating and drinking. Both sexes are obnoxious to its attacks, but whether with equal frequency or otherwise has not been determined. The joints which are most liable to suffer are those of the hip, elbow, wrist, and fingers; one of which only may be affected, or a number may be implicated simultaneously, or in more or less rapid succession. Sometimes the disease leaves one articulation, and fastens itself upon another; but, in general, when it has once effected a firm lodgment it holds on to it pertinaciously, now and then remitting, but seldom entirely intermitting, at least not for any length of time. Ill-fed and ill-clothed persons, living in moist, underground apartments, or in damp, confined alleys, are particularly prone to attacks of this sort. A gouty, rheumatic predisposition probably favors its outbreak.

The immediate *cause* of this disease is generally a suppression of the cutaneous perspiration from exposure to cold, or from long-continued immersion of the feet in water, as often happens in the laboring classes. Sometimes its origin is traceable to external injury, as a blow, sprain, or concussion. In the female, it is occasionally apparently dependent upon irregularity of the menses; and in both sexes it is often connected with disorder of the digestive apparatus, as dyspepsia, constipation, or derangement of the biliary secretion.

The disease often, if not ordinarily, approaches in a slow and stealthy manner, the first *symptoms* being usually merely a sense of soreness and stiffness of the affected joint, with slight derangement of the general health. As it progresses, the local distress assumes a more marked and open character; what was before only a feeling of

uneasiness now becomes a source of real pain and distress. The joint, gradually growing rigid, moves with great difficulty, and a careful examination seldom fails to detect fluctuation, dependent upon the presence of synovial fluid, an early product, and generally the principal one, of the inflammation in its milder forms. When the effusion is considerable it will necessarily seriously change the contour of the affected joint, the synovial membrane bagging across the ligaments, as is so apt to happen when the disease is seated in the knee, wrist, or elbow. It is seldom that pus forms in any case, even if unusually severe and protracted; but plastic matter is often poured out, in large quantity, and it is the presence of this substance that causes the remarkable rigidity which so constantly attends the complaint in its more severe grades. Spasmodic twitchings of the muscles in the neighborhood of the affected joints commonly set in at an early period of the inflammation, and constitute a source of great distress, effectually interrupting sleep, and requiring large doses of anodynes for their subjugation.

The pain in chronic rheumatic arthritis is often excessive; it is always increased by motion and pressure, and is usually materially aggravated at night. It is of a dull, heavy, aching character, and frequently extends in different directions, but especially along the course of the larger nerves, which it sometimes follows to their very extremities. The general health suffers severely; the patient is feverish, and deprived of appetite and sleep; the bowels are constipated; and the skin is hot and arid. The urine, however, although commonly scanty and high colored, does not deposit any lithic acid, a circumstance which remarkably distinguishes this disease from gout and rheumatism, properly so called.

In old cases of this disease, or in the strictly chronic form of it, the general health, although perhaps somewhat impaired, is comparatively good, and the patient may even grow fleshy and ruddy. His locomotive powers, however, are greatly deranged, and he is, in consequence, often obliged to use crutches. The affected joints are habitually tender, sore, and distorted, perhaps frequently presenting an appearance of being partially dislocated. Such a change is particularly liable to occur in the fingers, but is also occasionally noticed in the hip, shoulder, and other large articulations. Exostoses sometimes spring from the sides of the affected joints, and serve to add to the deformity, already sufficiently great. The synovial bursæ are also apt to suffer, becoming inflamed, enlarged, and distended with fluid. The muscles, in consequence of their perpetual inactivity, become atrophied and powerless. What strikes the observer as very peculiar, amidst these changes, is the entire absence of cretaceous deposits in and around the disabled joints.

Chronic rheumatic arthritis is essentially an inflammatory malady. If the affected structures be examined in the earlier stages of the disease, they will be found to exhibit indubitable evidence of vascular injection of the synovial membrane, and of the presence of synovial fluid, with here and there, perhaps, a patch of lymph, or more or less of this substance intermingled with the other secretion. Pus, as

already stated, is seldom seen in any case. When the disease is permitted to go on unchecked, great structural changes gradually take place, consisting in the removal, either partial or entire, of the synovial membrane and articular cartilages, and the conversion of the extremities of the bones into a hard, ivory, or porcellaneous substance, totally destitute of its normal qualities. In many cases the ends of the bones have a beautiful polished aspect, being perfectly smooth and glistening; while in others they are remarkably rough and tuberculated, or beset with exostotic incrustations. The inter-articular fibro-cartilages are generally completely destroyed, and the funicular ligaments often undergo partial absorption, while the capsular are liable to become stretched and relaxed, thus allowing the bones to slip away from each other, and produce an appearance of being partially dislocated. Finally, fibroid, fibro-cartilaginous, and osseous growths of various shapes and sizes, are extremely prone to form in the interior of joints thus affected; but as these have already been described in a preceding section, no further mention of them need be made here.

What is the *pathology* of this disease? That it is of an inflammatory nature is unquestionable; but how it is produced, or what the peculiar condition of the system is which predisposes to its development, or which keeps the affection in play after it has been fairly established, are circumstances in its history of which we are totally ignorant.

The *diagnosis* of this affection is, in general, sufficiently easy, especially in its more chronic forms. The history of the case, the excessive obstinacy of the disease, and the gradual failure of the functions of the affected joint, together with its distorted appearance, and the absence of cretaceous deposits in the structures around the articulation, and of lithic acid in the urine, always readily distinguish it from ordinary gout and rheumatism, the only maladies with which it is at all liable to be confounded.

The *prognosis* of chronic rheumatic arthritis is generally most unfavorable. In the milder forms of the disease, and in its earlier stages, a cure is certainly occasionally practicable, but under opposite circumstances the patient almost invariably remains a cripple for life, it being impossible by any mode of treatment at present known to effect restoration of the disorganized structures of the affected joints.

Treatment.—In the treatment of this affection, everything depends upon the efficiency with which the case is met in its earliest stages; for after the morbid action has made serious inroads, all that can, in general, be expected from our remedial interference is a mitigation of suffering, but seldom anything like a complete, permanent cure. Unfortunately it but too often happens that the disease has occasioned great disorganization of the affected structures, before the practitioner is afforded an opportunity of taking it in hand. Considering its inflammatory character, the course of treatment to be adopted is indisputably the antiphlogistic, directed not to the part merely, but also, and in an especial manner, to the state of the general system, which, whatever may be the real pathology of the disorder, is always more or less extensively implicated. In this country there are few cases of

chronic rheumatic arthritis which will not, in their earlier stages, bear active depletion by the lancet, purgatives, diaphoretics, and antimonials. The quantity of blood taken from the arm must of course depend strictly upon the condition of the constitution, as to the existence or absence of plethora, anorexia, and other evidence of vascular disturbance. Mercurial purgatives, administered in efficient doses, in union with jalap or rhubarb, and compound extract of colocynth, are among the most efficient means that can be employed for arresting the morbid action; and it would be difficult to conceive of any case in which they can altogether be dispensed with. At the same time, however, they must be used with caution. The improvement of the secretions always forms an important indication, and there is no class of remedies so likely to do this promptly and effectually as purgatives. After the violence of the disease has been moderated by these means, the most efficient prescription, according to my observation, is a combination of morphia, antimony, and veratrum, given in full and sustained doses, until it makes its specific impression upon the heart and nervous system. One grain of morphia, with one-sixth of a grain of tartar-emetic, and ten drops of veratrum, is a fair average dose for an adult, to be repeated once or twice in the twenty-four hours, according to the severity of the suffering, or the effects of the remedy, which should, of course, always be carefully watched. Administered in this way, it is sure promptly to subdue pain, produce perspiration, and reduce vascular excitement. When this result has been brought about, the medicines are given in smaller or less frequently repeated doses, until the necessity for their exhibition entirely ceases.

Colchicum is seldom of any material benefit in this disease in any of its stages; for, although the disorder unquestionably generally partakes of a rheumatic or gouty nature, yet, as already stated, there is rarely any lithic deposit in the urine, or cretaceous formation within the joints, and this is probably one, if not the principal, reason of the inefficiency of the medicine. Dover's powder, so highly extolled by some practitioners in the treatment of chronic rheumatic arthritis, is both bulky and nauseous, and in every respect inferior to the articles mentioned in the preceding paragraph.

Among the more important topical remedies are leeches and fomentations, medicated with acetate of lead, opium, and aconite. Local steam baths are sometimes highly beneficial, the vapor being conducted by means of a tube directly to the inflamed parts. Cold applications are rarely admissible in any case, from their tendency to shock the system, and cause metastasis. As the disease declines, recourse should be had to the dilute tincture of iodine and to steady compression with the bandage. At a still later period, passive motion must be instituted, and the parts around the joint must be well douched and shampooed twice a day, in order to promote the absorption of effused fluids and the restoration of impaired function.

In the more advanced chronic forms of the affection the main reliance of the practitioner must be upon a proper regulation of the diet,

which must be chiefly of a mild, farinaceous character, with a little white meat or fish at dinner; the preservation of the secretions by the occasional exhibition of a few grains of blue mass, or calomel; the steady, persistent use of iodide of iron, either alone or in union with iodide of potassium, in doses of from three to six grains, three times a day; and a residence in a dry, genial climate, exempt from sudden and severe vicissitudes. A sojourn of from three to six months at the Hot Springs in Arkansas, with the daily use of the warm baths obtainable at that place, will often prove serviceable. If the general health is much broken, cod-liver oil with iron and quinine may be required. In all cases the body should be incased in flannel, and gentle exercise should be frequently taken in the open air; a precaution of paramount importance in regard to the prevention of anchylosis, which is always so much favored by inactivity in all articular affections, whatever may be their character.

SECT. VIII.—ANCHYLOSIS.

By this expression is meant the stiffness of a joint, the effect of disease of some of its component elements, its etymology having reference to the angular deformity which so generally characterizes the affection. Several varieties of the complaint are met with, of which those commonly recognized are the complete and incomplete; all motion in the former being annihilated, while in the latter motion still exists, although in a very limited degree. There is another form of stiffness, in which the structures of the joint retain their normal characters, but are prevented from being exercised by disease in the neighboring tissues; and this circumstance has induced the division of anchylosis into true and false, or into intra-articular and extra-articular. This classification is not only more philosophical than the other, but is of paramount importance in a practical point of view, as it leads to a just appreciation of the etiology of the disorder, and also, as a necessary consequence, to proper therapeutic indications. The terms complete and incomplete refer, in fact, merely to different degrees of the same complaint, and might be very well replaced by the words fibrous and osseous, as more expressive of the true nature of the anchylosis.

1. *Intra-articular Anchylosis.*—Intra-articular anchylosis may be produced by whatever has a tendency to excite inflammation in the synovial membrane of the joints, with deposits of plastic matter upon its free surface. Hence it may arise from all kinds of external injury, as wounds, sprains, blows, and contusions; the presence of inter-articular bodies; luxations, especially neglected ones; and fractures which involve the joints, or are situated in their immediate neighborhood. Gout, rheumatism, syphilis and struma also act as exciting causes; but of all these causes, as well as others that might be referred to, there are none which, according to my experience, so frequently occasion anchylosis, permanent and irremediable, as fractures and dislocations. Long disuse is another circumstance which powerfully

disposes to the occurrence of stiffness of certain articulations, especially those of the fingers, wrist, and elbow. I am aware that the force of this influence has been denied, but certainly not upon just grounds; for modern experience has shown, and my own observation has repeatedly verified the fact, that this cause alone is often capable of producing anchylosis of a very obstinate and intractable character. Such an event need not surprise us if we remember that motion is the appropriate stimulus of an articulation, and that more or less of this is just as necessary to its healthy action as food is to the stomach, light to the eye, or sound to the ear. When motion is suspended for any length of time, the synovial membrane becomes dry and stiff, and eventually taking on inflammation, it pours out plastic matter, which effectually obliterates its cavity and so induces permanent anchylosis, on the principle that when the function of a part is destroyed its structure is also destroyed, or, at all events, essentially changed in its character.

All joints are liable to this variety of anchylosis, but it takes place much more easily in the ginglymoid than in the orbicular, and among the former it is more frequently witnessed in the knee, elbow, and wrist, than in any others. Several joints are sometimes involved in the occurrence, especially when it happens in consequence of gout, rheumatism, or syphilis, and a number of cases have been published in which nearly every articulation in the body was completely anchylosed, the skeleton forming almost one rigid piece.

In every case of intra-articular anchylosis a series of changes is obliged to take place before the loss of function can be said to be complete. Hence if we examine a joint which is about to become thus affected, it will be found that the first step consists in the effusion and organization of plastic matter, and the second in the gradual conversion of this matter, first, into fibrous, or cellulo-fibrous tissue, then into cartilage, and finally into bone, the latter forming the ultimate link in the morbid chain. A fibrous, or fibro-cellular anchylosis generally terminates, and that at no distant period, in osseous anchylosis, the change from one to the other being regularly progressive until the process is completed, this being the method which nature adopts to effect a cure when any serious accident befalls a movable articulation.

These adhesions and transformations vary in extent, not less than in structure and consistence. Sometimes they are very limited, a considerable portion of the synovial membrane remaining sound, or being only slightly affected by disease, and, under such circumstances, the connection between the opposing surfaces is generally easily broken, so that ultimately the joint may regain its original functions. In a second series of cases, again, the fibrous, or fibro-ligamentous bands are more numerous, extending from different points of one articular cartilage to the other, and thus effectually obliterating the synovial cavity, or, at all events, completely destroying its usefulness. Finally, in a third series of cases, the new tissue becomes the seat of osseous deposits, which, going on gradually increasing, in time usurp the place of the synovial membrane and cartilage, and, bringing the extremities

of the two bones in contact, fuse them firmly together; so that if a section be made of what was once the joint, their areolar and solid structures will be found to be inseparably blended, their junction being no longer indicated by the thin layer of compact substance which originally invested their heads. These changes are well seen in the annexed sketch (fig. 229), representing osseous anchylosis of the knee, from a specimen in my cabinet. The femur and tibia are firmly soldered to each other, and the patella to both, the three forming one piece.

Fig. 229.



The *treatment* of this variety of anchylosis must vary according to the nature and extent of the tissues upon which it depends, and also, in no inconsiderable degree, upon the character of the articulation. When the case is of recent standing, when the adhesions are weak and of limited extent, and when the joint is not too complicated in its structure, a reasonable hope may be entertained that the new tissues may be broken up, and brought fully under the action of the absorbents, so that, in due time, and with proper diligence, the functions of the joint may be measurably, if not completely, re-established. Under opposite circumstances, however, a cure will not only be difficult, but generally impracticable.

Much may be done in most cases of intra-articular anchylosis, in the way of prevention, by the steady and persistent use of sorbefacients and passive motion, as advised in the chapters on fractures and dislocations. The attendant inflammation having been divested of its violence, the plastic deposits must be disposed of before they have an opportunity of becoming firmly organized, and the only way in which this can be effected is by frictions with stimulating lotions, aided by the cold or hot douche, and by rubbing the articular surfaces gently against each other, at first once every forty-eight hours, and then once or twice a day, until all the matter has been absorbed, and the synovial membrane has regained its primitive characters. Much more skill and attention are required in these cases than the surgeon is usually willing to bestow, and it unfortunately too frequently happens that their entire management is confided to persons who are wholly ignorant of the manner in which it should be conducted. The consequence is that a great deal of harm is commonly done, which it is impossible subsequently to rectify by any mode of treatment, however carefully carried out. For the most part, indeed, the time for

successful interposition has gone by when the case falls into judicious hands.

When, through neglect, mismanagement, or unavoidable circumstances, the movements of the joint have become greatly impaired, or when the case has already attained a certain degree of chronicity, instead of abandoning the patient to his fate, an attempt should be made to break up the adhesions by forcible means, not forgetting, however, that they must, nevertheless, be conducted with a certain degree of gentleness in order to prevent mischief. The patient being placed under the influence of chloroform, the distal portion of the limb is moved with one hand, while the proximal, or that nearest the trunk, is firmly steadied with the other, at the same time that it rests upon a smooth, solid surface, so as to afford a better fulcrum for the other part to move upon. Thus, when we wish to break up the adhesions in anchylosis of the knee, the thigh is firmly pressed upon the table, while the leg, drawn away from its edge, is alternately flexed and extended to as great a degree as may be compatible with safety. In operating on the elbow a similar procedure is adopted, the arm being the fixed, and the forearm the movable point. Much muscular power is frequently required to conduct these movements, and yet the greatest care must be taken so to distribute this power as not to produce any mischief. Not long ago, in one of my cases at the College Clinic, I was so unfortunate, in attempting to remedy an anchylosed elbow, as to fracture the humerus just above the joint, the accident being announced by a loud snap, very different from the crackling noise which attends the severance of fibrous, or cellulo-fibrous bands. The patient was an old female, aged sixty-five, who had dislocated her elbow nearly three months previously, and it is highly probable that the bone had become softened and brittle from an extension of the inflammation. Such an occurrence is not always avoidable; for I am quite sure that in the case in question I did not use near as much force as I had often employed before on similar occasions without any such mishap.

The amount of force and the length of time during which it should be continued must vary according to the circumstances of each individual case, epecially the strength and extent of the adhesions. The efforts should always be very gentle at first, and be gradually increased as the parts are found to yield. If the joint be tender when the case comes under treatment, it may be necessary to spend a few days in preliminary treatment, dieting, purging, and perhaps even bleeding the patient, to prepare him for the approaching ordeal. The subsequent management must be of a strictly antiphlogistic character, and the repetition of the operation must depend upon the effects of the first trial; at all events, it should now be conducted with great gentleness, and rather with a view to a passive than an active result. In many cases it will be found advantageous after the first efforts to extend the joint by an angular splint, worked by a screw, and worn steadily until the object is attained, the degree of tension being regulated at will by the patient. Apparatus for fulfilling these indications is delineated in the accompanying sketches. Fig. 230 represents Kolbé's con-

trivance for straightening the knee; and fig. 231 that of Stromeyer, modified by Mütter, for rectifying anchylosis of the elbow.

Fig. 230.

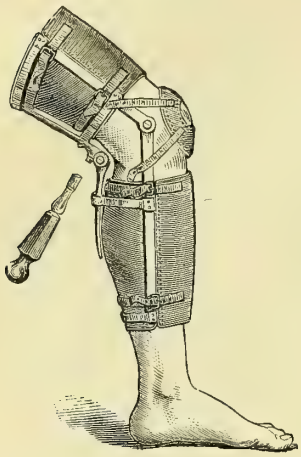
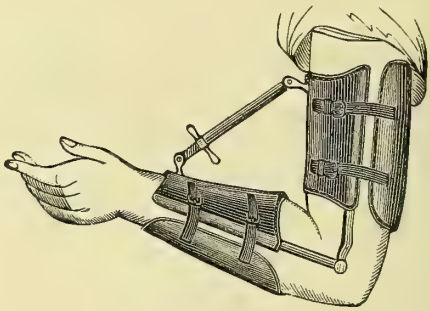


Fig. 231.



These attempts at curing anchylosis may not only eventuate in fracture of the bones, either of the joint itself, or of those in their immediate vicinity, but they may give rise to consequences still more disastrous, as violent inflammation, erysipelas, gangrene, and loss of life. It will be perceived, then, how cautiously all such procedures should be conducted, although they are unquestionably always less hazardous when conducted with the hands than when made with the aid of machinery.

Finally, when it is found that there is no possible chance of effecting a cure, but that anchylosis is inevitable, every effort, compatible with safety, should be made to place the affected limb in a situation most conducive to its future usefulness. Thus, the wrist should be straight; the elbow bent at a right angle with the arm; and the arm be brought close to the side of the body, and as far forward as possible, to enable the patient to put his hand to the mouth. In anchylosis of the hip, the thigh is flexed a little upon the pelvis; when the knee is concerned, the leg is inclined somewhat backwards; and in anchylosis of the ankle, the foot is placed at a right angle to the leg; the parts being found to be most serviceable when held in these several positions.

Bony anchylosis is incurable, except by an operation, which consists in cutting out a V-shaped portion of bone, as originally proposed and successfully executed by that excellent surgeon, Dr. John Rhea Barton, in 1826. His patient was a sailor, twenty-one years of age, who had lost the use of his hip-joint, in consequence of an injury from a severe fall on shipboard. The thigh was drawn up nearly at a right angle with the axis of the pelvis, the knee projecting inwards across the sound limb, and the foot presenting forwards. All attempts at correcting the malposition having failed, a crucial incision was made through the integuments, over the most prominent part of the great

trochanter, and raising the flaps thus defined, the operator next detached the muscles connected with this portion of the bone, making a passage both in front and behind the femur for the easy introduction of the finger. With a saw constructed for the purpose, he now divided the bone through the great trochanter and a part of its neck in a transverse direction. The wound being lightly dressed, the limb was placed in Desault's fracture-apparatus, as modified by Physick, and the case managed upon strictly antiphlogistic principles.

Twenty days after the operation the limb was gently and cautiously moved, in different directions, but neither so long, nor so violently as to produce severe irritation. At first, the motion was repeated only every other day, but afterwards every twenty-four hours, for four months, at which time the artificial joint had acquired such a degree of freedom as to enable the patient to walk about with the aid merely of a cane. The wound had healed, and he could not only rotate the foot, but abduct it twenty inches, and carry it forwards and backwards to a still greater extent. The case is reported in full, with an illustrative plate, in the third volume of the North American Medical and Surgical Journal.

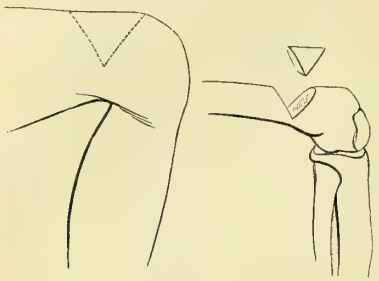
The operation of Dr. Barton, or, more correctly speaking, an operation conducted upon similar principles, is particularly applicable to the relief of deformity of the lower extremity, dependent upon anchylosis of the knee-joint. The proceeding was first executed by Professor Gibson, in 1838, in the case of a boy, seventeen years of age, who made an excellent recovery, the limb being only half an inch shorter than the sound one. It is divided into four distinct stages. In the first, a triangular flap is made of the soft parts in front of the limb, consisting of the integuments and the extensor muscles, by making two horizontal incisions, one just above the superior border of the patella, and the other two inches and a half higher up, down to the bone. This flap, which has a broad base on the inside of the thigh, is then dissected up, and held out of the way. The next step is to remove a V-shaped portion of the femur, which is easily done with a narrow saw, care being taken not to divide the bone completely for fear of injuring the popliteal artery. In the third stage the bone is fractured, by gently flexing the limb; and, lastly, the flap is replaced and secured by suture. The dressing is completed by putting the limb on a double inclined plane, where it is retained for the next ten days, or until the ends of the broken bone have become enveloped in plastic matter, when it is placed in the straight position, in a suitable apparatus for insuring quietude. The patient is usually able to rise, and walk about on crutches, in six weeks.

The sawing of the bone constitutes one of the leading objects of interest in this operation; if the wedge-shaped piece is too large, there is a possibility of non-union, whereas, if it is too small, it may be impracticable to straighten the limb sufficiently. In order to avoid these contingencies, all that is necessary is to measure the angle of deformity, and then to saw out a portion of bone equal to the complement of that angle. The adjoining cut (fig. 232) will afford a better idea

of the nature of the operation than any description of it, however elaborate.

Dr. J. Kearney Rodgers modified this operation by connecting the ends of the bone with silver wire, on the supposition that the proceeding would tend to expedite their reunion. Such a measure, however, is hardly required, if proper care be taken to keep the limb well secured during the after-treatment.

Fig. 232.



Of the results of this operation we have, unfortunately, no statistics, and are, therefore, not in a condition to offer any opinion respecting its merits. I believe, however, that in most of the cases in which it has been performed, the issue has been favorable. When the operation is done at the knee, the risk is always greater when the joint retains a portion of its natural structures than when these structures are completely annihilated.

2. *Extra-articular Anchylosis.*—In extra-articular anchylosis, the spurious anchylosis of some authors, the articular structures retain, at least for a time, their normal characters, but their functions are impaired, or suspended, by the diseased condition of the surrounding parts. Several distinct causes may induce such a result, of which muscular contraction, vicious cicatrices, osseous deposits, and the pressure of new growths, or aneurismal tumors, and paralysis of the articular muscles, are the most common and efficient.

a. Of the several causes here enumerated, as capable of producing rigidity of a joint, permanent contraction of the muscles and tendons, which naturally influence and control its movements, is the most frequent. We meet constantly with examples of this in gout, rheumatism, fractures, and dislocations, where, from an extension of the inflammation, which attends these diseases and accidents, motion is greatly impeded, if not completely destroyed, by this occurrence. The influence exerted by permanent contraction of the muscles, is well illustrated in club-foot and analogous distortions, where the joints are not only crippled in their functions, but greatly changed in their form and relations, giving the limb that peculiar aspect, from the resemblance to which it derives its name. Similar effects may be caused by the contraction of the aponeuroses, as is witnessed in the affection just mentioned, as well as in several others.

b. Secondly, a joint may become stiff in consequence of the existence of a vicious cicatrice, as that, for instance, caused by a burn, or scald. The tendency of the new substance, called by the French pathologists the inodular tissue, is to go on contracting until it produces hideous deformity, stretching the soft parts to their utmost capacity, and drawing the neighboring articular surfaces completely out of their natural position. The morbid adhesions formed after ulcerative

mercurial ptyalism, generally give rise to distressing and often irremediable anchylosis of the temporo-maxillary articulation.

c. In gout, rheumatism, and other affections, as well as in certain accidents, the motions of the joints are occasionally destroyed by the formation of osseous bridges, extending across the articulation, from one bone to the other. Such an occurrence is most frequently met with in the sacro-iliac symphyses, and in the joints of the vertebræ; it sometimes occurs also in the more perfect joints, especially the ginglymoid. In fractures, followed by exuberant callus, the muscles and tendons, in the vicinity of the neighboring joint may be so completely imprisoned by the new matter, as to cause anchylosis of the worst kind.

d. Anchylosis may be produced, in greater or less degree, by the development of various kinds of tumors, or morbid growths, in the neighborhood of an articulation, or in direct contact with it, interfering with its functions, and ultimately, if not removed, perhaps annihilating them. Thus, an aneurism of the popliteal region may cause stiffness of the knee, and an osteo-sarcoma of the jaw, partial anchylosis of the temporo-maxillary joint.

e. Finally, paralysis of the muscles of a joint may induce a certain degree of anchylosis; I have repeatedly observed cases where, from long disease of an articulation from this cause, its functions were permanently lost. The shoulder-joint frequently becomes stiff and useless, from palsy of the deltoid, interfering with its natural movements.

It is extremely probable that most of the causes here enumerated may, if long continued, induce permanent anchylosis, in consequence of the operation of the general pathological law, that when a part ceases to perform its functions, it gradually degenerates, and is ultimately completely deprived of its characteristic attributes. Nature abhors everything that is useless, and when a joint is once rendered passive, the synovial membrane, losing its secreting faculty, becomes dry, and is at length converted into fibrous, or fibro-cellular tissue.

The *treatment* of extra-articular anchylosis must be regulated by our knowledge of the nature of the exciting cause, which should, therefore, always be clearly ascertained before we attempt to interpose any curative agents. Thus, if it be found to depend upon contraction of the muscles, tendons, or aponeuroses, whether singly, or unitedly, the only remedy, in confirmed cases, is their subcutaneous division, an operation which will be fully considered in the chapter on club-foot; whereas, in recent cases, it may often be relieved by a course of friction, douching, and passive motion, aided by gentle exercise on the part of the patient. Vicious cicatrices must be cut out, and, if possible, replaced by new substance; such a procedure, however, is not always practicable, and hence most cases of this description go on from bad to worse until they are rendered wholly irremediable. Osseous bridges, circles, or bands may occasionally be removed with the saw and pliers; morbid growths are exsected, or, as in aneurism, the artery leading to it is tied; and paralysis of the muscles is relieved by stimulating frictions, the cold douche, shampooing, and electricity, the general health being at the same time improved by tonics, alterants, and exercise in the open air.

SECT. IX.—NEURALGIA.

The joints are occasionally the seat of neuralgia, although much less frequently than is generally supposed, especially if it be regarded as an independent lesion. As a complication of coxalgia and other articular affections it is not uncommon. During my long residence in the Southwest, where neuralgia is exceedingly frequent, in every form, I witnessed comparatively few cases of it in the joints, although I met with it constantly in other parts of the body; and, from what I can learn, it is also unusual in the northern and eastern States. In our more southern latitudes, too, it is seldom observed. It is not improbable, moreover, that in many of the cases in which it is supposed to attack the joints it is in reality situated altogether exterior to them, in the structures immediately around, and not in those concerned in their composition. Any of the articulations may suffer from this disease, but it is by far more frequently met with in those of the knee and hip than in any others. Neuralgia, considered as an independent affection, is most frequent in young, delicate, nervous females, soon after the appearance of the menses, of the derangement of which it is occasionally an exponent. No period of life, temperament, habit, or occupation, however, is exempt from it. The attacks are sometimes strictly periodical, precisely like those of an intermittent fever, coming and going regularly once a day, or every forty-eight hours; but more frequently they are irregular, the patient being tormented nearly constantly, the pain being now slight, now severe, and then perhaps again entirely absent, though never very long at one time. The paroxysms are frequently coincident with neuralgia in other parts of the body, alternating with it, usurping its place, or going on with it simultaneously. The pain is either of a dull, heavy, aching character, or sharp, lancinating, and darting, flying about in fits and starts, in different directions, almost with the rapidity of lightning. It is usually attended with more or less soreness and tenderness on pressure, motion, and percussion, and sometimes with a slight degree of tumefaction or puffiness of the parts around the affected joint, which often entirely disappears in the intervals of the attacks. Motion also is usually somewhat impeded. In the more aggravated cases the whole limb may be swollen, tender, and disabled, and under such circumstances there is commonly also a sense of numbness, extending to the very extremity of the member. The general health is not always appreciably affected; often, however, there is marked disorder of the digestive organs, with a sallow state of the skin, headache, and derangement of the renal secretion. In the female the symptoms are often of a hysterical character, and are liable to frequent exacerbations in consequence of the peculiar state of the mind, which is generally morbidly sensitive, and absorbed in selfishness and disagreeable forebodings.

It is of great moment to discriminate carefully between neuralgic and other affections of the joints, inasmuch as a wrong diagnosis may lead to serious errors in practice, inducing perhaps the employment of harsh measures where gentle ones alone are required; or, on the other

hand, allowing the patient to move about and exercise the joint when he ought to observe the most perfect quietude. In general, the history of the case, the peculiar nature of the pain, the suddenness of the attack, the absence of constitutional disturbance, and the perfect freedom of motion of the affected joint, when the surgeon takes hold of the limb and attempts to carry it about in different directions, will serve to distinguish it from those organic diseases to which the articulations are liable. Where, however, there is any doubt respecting the real nature of the complaint, the examination should be repeated again and again, and varied in every possible manner, so as to elicit the true state of the case. In many instances the best diagnostic is the success or failure of anti-neuralgic remedies.

In the *treatment* of this affection the first thing to be done is to ascertain, if possible, the nature of the exciting cause, and then to direct our remedies accordingly. Attention to the diet, bowels, and secretions should, in every case, receive prompt consideration, and should be kept prominently in view throughout. The malady very often has its origin in a vitiated state of the alimentary canal, or in the suppression of some important habitual discharge, by correcting or restoring which the symptoms frequently disappear without any further treatment. In general, however, anti-neuralgic remedies, properly so called, will be needed, and of these the best, according to my experience, are quinine, strychnine, and arsenious acid, in doses varying from three to five grains of the first, with the twenty-fifth of the second, and the tenth of the last, three times in the twenty-four hours. When there is marked evidence of anemia, iron may be advantageously combined with these remedies. If, on the other hand, the patient is plethoric, I usually add to each dose about the sixth or eighth of a grain of tartar-emetic, with a view to its relaxing and diaphoretic effects. Morphia also forms a valuable adjuvant, and can rarely be dispensed with in any case. Colchicum often proves very serviceable, and I have known it to afford prompt relief when everything else failed. It is particularly valuable when the disease partakes of a rheumatic or gouty character. In the hysterical form of the affection assafœtida and valerian may prove beneficial, but even here they are, as a general rule, far inferior to the articles just pointed out.

As topical remedies the most valuable are the soap liniment, with a liberal addition of laudanum and chloroform, kept constantly upon the part with a piece of flannel; and the steam of hot water, conveyed to the joint from a tube connected with a boiler near the bed. Leeches may be employed when the articulation exhibits evidence of being inflamed, but, as a general rule, they will be found to afford only very transient relief.

SECT. X.—DISLOCATIONS.

1. GENERAL CONSIDERATIONS.

A dislocation, or luxation, is the sudden and forcible removal of one articular surface from another, generally caused by external violence, and attended with more or less laceration of the connecting ligaments. The accident being of frequent occurrence, and liable, when neglected or injudiciously managed, to be followed by permanent deformity and lameness, should claim the serious attention of every practitioner, since his reputation for tact and skill will greatly depend upon the manner in which he acquits himself when he is required to take charge of such an injury. An unreduced dislocation, like a badly treated fracture, is often a standing monument of the surgeon's ignorance and incapacity; nay, what is worse than all, it sometimes involves him in ruinous law-suits and in entire loss of character.

As all joints are necessarily composed of at least two bones, the question naturally arises, which should be considered as the luxated one? Upon this subject all surgical authorities are, so far as I am acquainted with their writings, agreed. In all accidents of this description the bone nearest the trunk is regarded as the fixed bone, and the one articulated with it as the dislocated one. Thus, in luxation of the shoulder-joint, the scapula retains its normal position, either actually or supposititiously, while the humerus is thrown off the glenoid cavity, at one time in this direction, and at another in that. In dislocation of the elbow, the ulna and radius are forced away from the humerus, the latter serving as the fixed point. The same rule obtains in regard to all the articulations of the inferior extremity, except that of the ankle, in which, by a singular perversion of the manner of considering the subject, the foot is looked upon as the fixed point, and the tibia as the movable one.

Dislocations are divisible into simple and complicated, complete and incomplete, primitive and consecutive, recent and old. To these varieties may be added another, which, as it occurs during intra-uterine life, and probably depends upon imperfect development of the structures of the joints, has obtained the appropriate name of congenital. This form of luxation is of sufficiently frequent occurrence and importance to receive separate consideration.

A luxation is said to be *simple* when it is unaccompanied by anything more than a slight rupture of the ligaments, or of the ligaments and muscles. Although such an accident is usually produced by external force, as a blow or fall, yet it occasionally arises purely from muscular action, especially when the displacement is favored by preternatural laxity of the ligaments, disease of the articular surfaces, or a weakened and wasted condition of the muscles which surround and support the joint.

A *complicated* dislocation, on the contrary, is one where, in addition to the loss of relation between the two contiguous surfaces, there is some serious lesion of the soft parts, as, for example, a wound com-

municating with the displaced bone, or opening directly into the articulation, laceration of important vessels or nerves, contusion of the integuments and muscles, or fracture of the luxated bone. When the wound penetrates the affected joint, the accident is usually called a compound dislocation. All complicated luxations are necessarily the immediate and direct result of external injury.

A *complete* luxation is one in which the head of a bone being totally removed from its corresponding articular surface, effects a lodgment in a new situation; as, for instance, when the head of the humerus is forced down into the axilla, resting against the border of the scapula, below the glenoid cavity. In an incomplete luxation, on the contrary, the articular surfaces, although they have lost their relative position, remain still partially in contact with each other. Displacement of the head of the humerus against the coracoid process affords a good illustration of this variety of accident.

In *primitive* dislocation, the displaced bone continues in the position into which it was originally forced; in consecutive, it abandons its original situation, and becomes fixed in another. Such an accident, however, can only happen, as a general rule, when the luxation depends upon some organic disease of the articular surfaces, allowing them gradually to separate from each other, either by the mere weight of the corresponding limb, or by the action of the neighboring and associated muscles. In the traumatic form of the injury such an event must be exceedingly rare, although we must admit its possibility, the dislocating agent forcing the bone at once to the greatest verge of its displacement; or, as not unfrequently occurs, its farther progress is effectually arrested by some opposing osseous prominence or some tensely strung soft part, as a tendon, muscle, or fibrous membrane. Luxation of the knee-joint from caries of the articular surfaces furnishes a characteristic exemplification of these two kinds of displacement. In this accident, of which I have seen several cases, the head of the tibia gradually forsakes the condyles of the femur, slipping back into the popliteal region, from whence, in time, it is drawn up against the posterior surface of the bone by the flexor muscles, thus suffering secondary luxation. A similar occurrence, although exceedingly uncommon, may, nevertheless, happen in a very robust subject in traumatic dislocation of the hip, shoulder, or lower jaw, where the force is barely sufficient to lift the head of the bone out of its socket upon, but not over, its rim, from which it is afterwards removed either by mere muscular contraction or by the conjoint influence of this and the weight of the part connected with the displaced bone.

The terms *recent* and *old* refer merely to the duration of the injury, and might seem, at first view, to require no particular explanation. The propriety of this, however, will be rendered at once obvious if the question be asked, when does a dislocation become old? does it become old in a few days, or weeks, or months? As far as mere time is concerned, no lesion of this kind can be regarded as old unless it has existed for at least from six to twelve months; but if we look at the subject in a practical point of view, or, what is the same thing, in reference to our ability to restore the affected joint to its natural rela-

tions, it will be found that, while one dislocation may not be old at the end of several months, another may become so within the first few weeks. Thus, a luxated shoulder may frequently be successfully reduced after a lapse of two months, or even considerably later, whereas if we attempt to restore a dislocated elbow at the end of one-third or even one-fourth of that time, we shall generally signally fail. The import of these two terms, then, is one of much greater importance than has generally been admitted, having, practically considered, a positive value and significance.

In relation to its *seat*, it may be observed that nearly all the joints in the body are liable to dislocation; nevertheless, experience has shown, what a knowledge of the structure and functions of these parts might have led us to anticipate, that those which admit of varied and extensive motion are much more prone to this injury than such as enjoy only a very limited motion. Hence what are called the ball and socket joints, of which those of the hip and shoulder are the best representatives, are a great deal oftener affected than the ginglymoid, as those of the elbow and knee. The tables of Mons. Malgaigne have established the interesting fact that dislocations of the shoulder-joint are more frequent than those of all the other movable articulations together, 321 cases out of 481 having occurred here. Comparing the relative proportion of cases in the two extremities, the same distinguished observer finds that they are seven times more numerous in the superior than in the inferior. These differences in the relative frequency of this lesion in different joints are, as already stated, clearly referable to the differences in their structure and functions. Of all the large articulations in the body, that of the shoulder is the most insecurely constructed; the glenoid cavity is remarkably shallow; the capsular ligament is long and loose, and the joint, admitting of every variety of motion, is under the direct influence of numerous powerful muscles, and exposed to numerous accidents. Why, then, should we be surprised that it is so often the seat of dislocation? The hip-joint, on the contrary, is the most admirably contrived joint of which we can possibly form any conception; as a piece of mechanism it is perfect; the acetabulum is an immense socket, in which the whole head of the femur is literally buried, and to which it is still further secured by two powerful ligaments, the round and the capsular; and, in addition to all this, it is surrounded by numerous large muscles, which serve to support and protect it from injury. Thus constituted, this articulation is comparatively seldom the seat of dislocation, hardly, as compared with that of the shoulder joint, in the proportion of 1 to 9½. The clavicle, which enjoys only a very limited degree of motion, is not unfrequently luxated, its exposed situation and its buttress-like office rendering it peculiarly prone to the accident, occupying, in this respect, nearly the same rank, according to Malgaigne's statistics, as the hip-joint.

Thus, recapitulating what has been said above, we may conclude that the most powerful predisposing causes of dislocation are, varied and extensive motion of the joints, want of firmness between the articulating surfaces, arising either from their shallowness or the

structure and arrangement of their ligaments, and the exposed situation and peculiar functions of the bones entering into their composition.

The *direction* in which dislocations occur is subject to much diversity, depending upon the nature of the joint, and the direction in which the force is applied at the time of the accident. In the ginglymoid articulations the bones may be displaced backwards, forwards, or to either side; in the orbicular, as, for example, that of the shoulder, downwards, forwards, upwards, or backwards.

Although dislocations may occur at any *period of life*, yet experience has shown that such accidents are much more frequent in middle-aged and elderly persons than in children and youths. The reason of this difference is to be found in the circumstance that the bones of young subjects being comparatively soft and pliant, and not yet everywhere completely solidified, yield most easily at their epiphyses and even at their shafts, while those of very old and decrepit people are generally so brittle that it requires much less force to break than to dislocate them. It is seldom that we have an opportunity of seeing a dislocation of the hip-joint after the age of sixty, while it is sufficiently common to meet with fracture of the neck of the femur within the capsular ligament. This statement, however, must be received with some degree of restriction, for it is obviously not applicable to all the articulations. The shoulder-joint, for instance, forms a striking exception, its dislocation in old age being much more frequent than fracture of the superior extremity of the humerus.

Causes.—The efficient causes of dislocation are two, external injury, and muscular contraction, being, in fact, the same as those of fracture. Most cases are due to the former, acting either directly upon the joint, or indirectly through some bone articulated with it. Dislocation of the shoulder, consequent upon a blow or fall upon its top, affords a good illustration of the manner in which injury acts when applied directly to an articulation. In this case the force is spent upon the superior extremity of the humerus, propelling the head of the bone down into the axilla, beyond the glenoid cavity of the scapula. The femur may be luxated in a similar manner, by a heavy body falling on the hip, while the thigh is in a state of abduction. Lateral dislocation of the patella is another instance of displacement occasioned by direct violence. Sometimes a severe wrench is necessary to produce the accident, especially when the bones are connected by short and strong ligaments, requiring great force to separate them.

A more common mode of causing this accident is by the indirect application of force; indeed, there are few cases which are not produced in this way, whatever may be the nature of the articulation. Nearly all the dislocations of the upper extremity, and many also of the lower, are the result of violence, transmitted from the distal portion of the limb, and concentrated upon some particular bone, which thus loses its connection with the opposing surface. It is in this manner that falls upon the hand generally may luxate the wrist, the elbow, or even the shoulder, according to the point upon which the violence is exploded. Dislocation of the clavicle is usually induced by falls upon the shoulder, in which this bone is acted upon by two forces coming in opposite

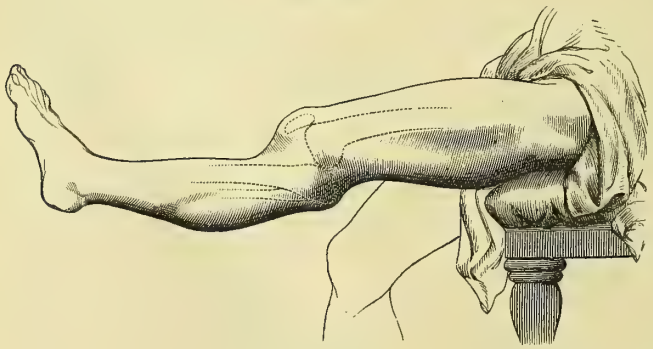
directions, the one being caused by the weight of the body, and the other by the object struck.

Of the ability of the muscles to induce this accident, experience has furnished ample proof. My own practice has afforded me several well marked cases of it; two having occurred in the shoulder, and the others in the lower jaw. Of the former, one was occasioned during an attack of epilepsy, and the other merely by raising the hand above the level of the head. Yawning is a common cause of dislocation of the temporo-maxillary articulation. Several cases have been recorded of displacement of the thigh-bone by muscular contraction. In the ginglymoid joints such occurrences must, for obvious reasons, be much less frequent than in the orbicular.

Some persons possess the power of dislocating certain joints by their own unaided efforts, simply by voluntary muscular action. I have seen several individuals who possessed this faculty, but I have always noticed that, however strongly they exerted their will, they could not produce anything like a complete displacement of the articular surfaces, and I presume that most of the cases that have been reported have been of this description. Dr. Haynes, of Saratoga, New York, has recently published the particulars of the case of a lad, aged seven years, who is said to be able to dislocate, and also to reduce, the joints of the knee, elbow, wrist, thumb and fingers, with perfect ease by muscular contraction.

In all cases of dislocation, whether the result of direct or indirect injury, or of muscular contraction, the accident is materially favored by a partial separation of the articular surfaces. The lower jaw cannot suffer displacement so long as it is closed, but if the chin be struck while the body is depressed, and the condyle drawn forward upon the anterior convex part of the temporal fossa, the slightest blow will suffice to throw the bone down over the root of the zygomatic process. Dislocation of the humerus into the axilla is greatly promoted by abduction and elevation of the arm. The femur is generally luxated upwards and backwards against the dorsal surface of the

Fig. 233.



ilium, by falls upon the hip, and the occurrence is always facilitated by the circumstance of the person having a heavy load on the back.

A twisted or contorted state of the limb is generally highly conducive to the accident.

Organic disease of a joint may become a cause of dislocation, as seen in the adjoining drawing (fig. 233), from a patient of Professor T. G. Richardson. The man, who was about middle life, had labored for a long time under an arthritic affection of the knee, which was gradually followed by permanent displacement of the head of the tibia backwards behind the condyles of the femur. There was no external disease of any kind. The head of the bone could easily be reduced, but could not be kept in position, owing, apparently, to the complete destruction of the ligaments of the joint.

2. SIMPLE DISLOCATIONS.

Dislocations are characterized by a certain train of *symptoms*, by which they may, in general, be easily distinguished from other accidents. Of these symptoms, the most constant and prominent are, loss of function of the affected articulation, lodgment of the displaced bone in an unnatural situation, deformity of the joint, and change in the mobility, length, and axis of the corresponding limb. To these may be added, as subordinate phenomena, the noise which is occasionally heard by the patient at the moment of the accident, numbness of the parts from pressure of the luxated bone upon the nerves, contusion and discoloration of the integuments, together with pain, swelling, and crepitation as effects of the resulting inflammation. The importance of the subject will require that each of these symptoms should be considered somewhat in detail.

Immediate and, generally entire, loss of *function* of the affected joint is a necessary consequence of dislocation, however induced. Thus, in luxation of the temporo-maxillary articulation, the lower jaw is widely separated from the upper, and all the efforts that the patient can possibly make are insufficient to shut his mouth. When the principal joints of the upper extremity are affected, the person is unable, without assistance, to carry his hand to the head, or to execute the motions of flexion, extension, circumduction, pronation, and supination; the whole limb feels heavy and numb, and requires to be supported by the sound one. In dislocation of the foot, leg, and thigh, progression is not only impracticable, but every attempt of the kind is attended with so much distress as to cause at once its discontinuance. The loss of function necessarily persists so long as the joint remains unreduced, although, in time, it is often partially regained.

It is not at all remarkable, when we consider the nature of this accident, that it should be attended with more or less impairment of the *motion* of the corresponding limb. The patient, in general, not only loses all voluntary control over the member, but the surgeon, upon taking hold of it, and attempting to carry it about in different directions, finds it impossible to effect his object. Motion, it is true, is not always completely abolished, but there is no case in which it is not considerably, if not greatly, restricted. In some of the articulations, as, for example, in that of the elbow, the displaced bones are so

thoroughly interlocked, or hooked together, as to render it difficult, even by the most adroit and persevering efforts at extension and counter-extension, to disengage them from each other, and restore them to their natural situation. Immobility, therefore, is one of the most valuable symptoms of dislocation. Its causes are threefold, muscular contraction, opposing osseous prominences, and constricting ligamentous bands, or all these united. A knowledge of these obstacles is of great practical moment, as it involves important therapeutic considerations, which should be well understood by every surgeon.

In most cases of this accident the surgeon is able to feel the displaced bone in its new *situation*, beyond the limits of the corresponding articular surface. Sometimes, indeed, it may even be readily detected with the eye, in consequence of the prominence which it forms by raising up the muscles and integuments beneath which it lies. In order to ascertain the precise position of the bone, a careful examination will generally be required, especially when there is much tumefaction obscuring the symptoms. For this purpose one hand is placed upon the injured joint, while the other is employed in moving the corresponding limb; when greater accuracy is necessary, this office is confided to an assistant, in order that both hands may be used for conducting the investigation. If the manipulation is productive of severe pain, it should be desisted from until the system has been brought fully under the influence of anæsthesia. The distance to which the head of the displaced bone is thrown varies, in different cases, from a few lines to several inches, depending upon the size and shape of the joint, and the amount of force employed in producing the accident; as a general rule, it is greater in the orbicular than in the ginglymoid articulations.

Deformity of the joint is another symptom of dislocation, and generally one of the most reliable. This usually manifests itself in a marked flattening of the articulation, as in dislocation of the humerus into the axilla, where there is always a loss of rotundity of the cushion of the shoulder from the manner in which the deltoid muscle is spread out; or in great increase of the width of the joint, as in lateral luxation of the elbow and knee. Sometimes the joint has a singularly contorted, angular, or twisted appearance.

A change in the *length* and axis of the limb articulated with the displaced bone is generally a prominent symptom. It is seldom that the limb retains entirely its normal length; most commonly this is either increased or diminished, the extent varying according to the structure of the joint and the degree of force employed to produce the accident. Shortening is much more frequent than elongation. Thus in the various forms of luxation of the shoulder and hip there is only one in each in which the limb is increased in length, while in all the rest it is considerably, if not greatly, shortened, amounting in some of them to several inches. No material difference exists in regard to this symptom in the dislocations of the orbicular and ginglymoid articulations.

Dislocation not only changes the length of the affected limb, but also, in most cases, its *axis*, giving it a peculiarly contorted or twisted

appearance. This appearance is nowhere more striking or conspicuous than in the displacements of the elbow-joint, in some of which it is almost diagnostic. Another excellent illustration of this occurrence is afforded in luxation of the head of the humerus into the axilla, where this trait is often so well marked as at once to convince the practised eye of the nature of the accident. In most of the displacements of the orbicular joints the limb stands off at a considerable distance from the body, in a constrained and twisted state.

Of the subordinate symptoms there is not one which is of any real value; nevertheless, they are deserving of some consideration, if it be for no other reason than that of completing the history of this accident.

It is highly probable that most dislocations, at least those of the larger joints, are attended with some degree of *noise* at the moment of their occurrence; but that this noise is not often heard by the patient may be assumed from the fact that he is so seldom conscious of it when interrogated respecting it. The reason of this no doubt is the confused state of his mind consequent upon the sudden and unexpected nature of the accident preventing him from perceiving it. Sometimes, however, it is so loud that he is compelled to hear it, as it were, in spite of himself. Its character cannot be easily described, but it may perhaps be said to bear a closer resemblance to a cracking noise than anything else to which it can be compared. It appears to be caused by the sudden and forcible separation of the articular surfaces, aided, probably, by the laceration of the connecting ligaments, and is generally most distinct in luxations of the orbicular joints.

A good deal of *numbness* is occasionally present in the parts immediately around the affected joint, or even in the whole of the corresponding limb. It evidently depends upon the compression of the nerves by the displaced bone. This symptom is always remarkably conspicuous in dislocation of the humerus into the axilla from the head of this bone pressing upon the brachial plexus, the tingling sensation often extending to the very tips of the fingers.

A certain amount of *contusion* and discoloration is often present in this lesion, but the occurrence is by no means constant; a circumstance which is almost to be regretted because it serves to indicate, in some degree, the seat of the injury. The contusion is sometimes accompanied by scratches of the skin, or even considerable wounds, which thus complicate the case. The discoloration varies from the slightest change of the normal hue to deep purple, depending upon the size and number of the vessels whose laceration is the occasion of it. Large quantities of blood are sometimes effused, but chiefly among the tissues in the immediate vicinity of the joint concerned, or among them and within the joint.

The *pain* which follows dislocations varies not a little in different individuals, depending, perhaps, often quite as much upon their idiosyncrasy as upon the severity of the injury. Its immediate cause, of course, is the rupture of the ligaments and other structures in and around the affected joint, and may, on the one hand, be so excessive as to induce fainting and other distressing effects, or, on the other, so insignificant as hardly to attract attention. It is always increased by

manipulation and motion, as well as upon the supervention of the inflammatory process, and frequently continues for days and weeks, depriving the patient of appetite and sleep. In nervous, irritable subjects it occasionally assumes a neuralgic character. When the displaced bone compresses an important nerve, it is generally attended with a feeling of numbness and tingling.

More or less *swelling* always succeeds to dislocations; sometimes almost instantly, but generally not under several hours; at one time slight, at another exceedingly severe. When it appears suddenly, within a few minutes after the accident, it is always due to effusion of blood, and is then either attended or soon followed by discoloration of the integuments. Coming on more slowly, there will be reason to conclude that it is the result purely of inflammatory deposits, especially serum and lymph, or of these deposits and of blood combined. When the incited action runs very high, the swelling will generally be proportionably great, the part being hard, stiff, glossy, painful, and intolerant of manipulation.

Much has been said and written concerning the *friction-sound* which occasionally attends recent unreduced dislocations, different authorities having ascribed it to different causes. By some, as J. L. Petit, it has been supposed to depend upon a dryness of the articular cartilages; others consider that it is due to the presence of a superabundance of synovial fluid; Sir Astley Cooper was of opinion that it proceeded from a deposit of fibrin within the joint and in the neighboring burses; lastly, Malgaigne thinks that it is occasioned by the rubbing of the head of the luxated bone against an osseous surface denuded of its periosteum. I have alluded to these various theories rather because they represent the views of distinguished authors, than on account of any intrinsic value which they may possess. The question of the real cause of this sound is still an open one, and more careful observation and dissection than have yet been made will be required before it can be finally settled. Meanwhile, I am strongly inclined to the belief of the English surgeon that it is mainly, if not wholly, due to plastic effusion into and around the articulation, and this idea is strengthened by the fact that it cannot be elicited until after the occurrence of inflammation. If it were caused by dryness of the articular cartilages, or denudation of the bone, it ought, as a natural consequence, to be perceptible immediately after the infliction of the injury, which, however, it never is.

The term friction perhaps expresses the nature of this sound better than any other that can be employed; it is entirely different from the grating noise and sensation caused by rubbing together the two ends of a broken bone; it is more like the sound occasioned by rubbing over each other two pieces of sole-leather; it is a soft creaking, or crackling noise, not a grating one.

Diagnosis.—The accident with which dislocation is most liable to be confounded is undoubtedly fracture, especially fracture in the vicinity of the articulations, an occurrence not only quite frequent, but generally exceedingly embarrassing, on account of the difficulty of its diagnosis. The most constant and reliable symptoms of dislocation,

as already stated, are, deformity, both of the affected joint and limb, loss of function, impaired motion, and difficulty of restoring the displaced bone to its natural situation. In fracture the most important characters are, distortion, preternatural mobility, and crepitation, with facility of reduction.

If we compare these symptoms with each other, we shall find that, although there is some resemblance between some of them, yet that, in the main, they are strikingly dissimilar, and, therefore, in so far, diagnostic of the accidents which they serve to characterize. Deformity is common to both dislocation and fracture, and is therefore of little, if any, value as a point of distinction between them. The same is true of the loss of function, which is often, perhaps generally, quite as great in the one as in the other. If a man with a luxated hip may occasionally support the weight of his body upon the affected limb, or even walk slightly upon it, he can sometimes do as much, and even more, when he has an impacted fracture of the femur, or a fracture of the neck of that bone temporarily unattended with a separation of the fragments. A dislocated jaw is quite as helpless as a broken one; in neither case can it perform the office of mastication. Both these symptoms, then, are without the slightest value in a diagnostic sense. But it is very different with the others above enumerated. Mobility, for example, is a differential sign of great value. In dislocation, mobility is either entirely lost, or, at all events, very much impaired; the displaced bone is more or less firmly fixed in its new situation, and can only be restored to its natural position by powerful efforts, often long and anxiously continued. In fracture, on the contrary, there is always an increase of motion, or, more properly speaking, there is preternatural mobility, the limb allowing itself to be bent, extended, and even rotated upon its axis. Moreover, by extension and counter-extension the member may be readily restored to its natural length and shape, but the moment these efforts are discontinued there is a reproduction of all the previous symptoms. Such an event never happens in dislocation; when the bone is once reduced it remains reduced, unless accident should again lift it out of its socket. Lastly, in luxation the replacement is usually attended with a peculiar noise or snap, caused by the forcible contact of the opposing surfaces; in fracture such a noise is never distinguishable. Crepitation is another valuable diagnostic in these accidents. In dislocation the only sound ever perceived is a kind of friction-sound, and this is never present until after the supervention of inflammation; in fracture, on the contrary, crepitation is one of the most important symptoms; indeed it is the characteristic sign of the lesion. It may be detected immediately after the accident, and during all stages of the after-treatment up to the time of incipient union. Deformity and preternatural mobility may both be absent, and yet if there be crepitation, or a rough grating noise and feel upon rubbing together the ends of the broken bone, there can be no doubt respecting the real nature of the case. It is a fracture, and nothing else. So, on the other hand, if there be deformity and loss of motion, with absence of crepitation, the rational inference is that the case is one of luxation, or, at all events, not one of fracture.

Another valuable sign in this accident, but one which has only a general application, is the difference in the position of the affected limbs in the two classes of injuries. In dislocation the limbs often stand off at a considerable distance from the body, in a constrained and unseemly attitude; in fracture, on the contrary, they always hang close by the side of the body. Most of the displacements of the hip and shoulder-joints exhibit this peculiarity, and I consider it as of no little value as a means of discriminating between these lesions and fractures of the superior extremities of the femur and humerus.

Contusion, discoloration, pain, and swelling being common to both dislocation and fracture, are worthless in a diagnostic point of view. Instead of being of advantage in this respect, they only, in general, serve to embarrass the attempts at discrimination. Numbness, however, possesses a certain value, especially in some of the luxations of the shoulder and hip, where it occasionally constitutes a prominent and distressing symptom, which is never the case in fracture, except under very rare circumstances, where the ends of the broken bone pierce or compress a large nerve.

Important aid may sometimes be derived, in our investigations, from a knowledge of the position which the dislocated bone is most liable to occupy. Thus, in displacement of the shoulder the head of the humerus is usually thrown into the axilla, or forwards against the chest, seldom upwards or backwards; the most common luxations of the femur are those upon the dorsal surface of the ilium and into the sciatic notch. In the ginglymoid joints, especially those of the knee and elbow, posterior displacement is most common.

After all, however, no matter what may be the character or prominence of the symptoms, a correct and reliable diagnosis can only be arrived at, in any case, by a thorough examination of the condition of the parts concerned. Without the light which such an investigation is capable of furnishing, no surgeon, however skilful or experienced, can always be certain whether the accident is one really of dislocation or of fracture, or whether these lesions do not co-exist. In conducting the examination, the same general rules are applicable as in fracture. The sooner, of course, it is made the less likely will it be to occasion severe suffering to the patient, or annoying embarrassment to the practitioner. When the parts have become tumid and infiltrated, the nature of the accident is usually very much obscured, and the manipulation only aggravates the already existing mischief. Besides, they will then be so painful as to render it impossible to touch them without putting the patient under the influence of an anæsthetic. It is unnecessary to say that when a joint is in this condition, it must be handled with the greatest care and gentleness, yet at the same time the exploration should be thorough, otherwise it cannot be satisfactory, and, if one trial is not sufficient, another should be made soon after the first, means being used, meanwhile, to allay pain and inflammation, in order to render the parts more tolerant of manipulation.

A careful measurement of the affected limb, or, rather, of the portion of the limb between the affected joint and the next one below, will often throw considerable light upon the diagnosis. Thus, if, in injury

of the shoulder-joint, the distance between the acromion process and the elbow be found to be considerably greater than on the sound side, it would be a legitimate influence that the case was one of dislocation into the axilla, and not of fracture of the head or neck of the humerus. In luxation of the elbow backwards, the forearm is always sensibly shortened, only, however, in front, for behind it must necessarily retain its normal length. The measurement must be taken with a piece of tape, which, in order to insure greater accuracy, should, if possible, be graduated, the ends being applied against two fixed points, and the same operation being performed upon the sound limb.

When, notwithstanding all these examinations and precautions, the case remains one of doubt, the surgeon should not hesitate to adopt the suggestion of Malgaigne, of inserting a long and slender needle into the joint, and also, if necessary, into the parts immediately around, with a view of ascertaining their precise condition. Should a hollow be found where there is naturally a projection, or a projection where there ought to be merely a cavity, the presumption will be strong that the case is one of dislocation, and the conjecture will be converted into positive certainty if there be an absence of crepitation and preternatural mobility. There can be no possible objection to such an exploration, if it be conducted with proper care in regard to the avoidance of the larger vessels and nerves, and if the instrument be sufficiently slender to make only a small puncture, and so well tempered as not to break. It is surprising when we consider the facility and safety of this operation, and the undoubted light which it is capable of affording in obscure cases of this accident, that it should not have attracted more attention, or been more frequently employed.

Finally, dislocations are sometimes painfully simulated by sprains, so much so, indeed, as to puzzle and perplex the most sagacious observer. Under such circumstances, nothing short of the most patient and accurate examinations and measurements, repeated again and again, in the recumbent and in the erect position, will be likely to prevent mistake.

Morbid Anatomy.—On dissecting a joint that has been recently luxated, the head of the bone will be found to be more or less removed from its socket, the distance to which it has been thrown ranging from a few lines to several inches, according to the structure of the parts involved, and the degree of force concerned in producing the accident. In the incomplete form of the lesion the articular surfaces still partially retain their apposition, while in the complete all connection is lost. The displaced head rests either upon some muscle, tendon, or bone, or upon all these structures, and the socket is generally occupied with blood, either fluid, or partly fluid and partly coagulated. The ligaments are lacerated, elongated, and relaxed, the extent of the rent varying from a mere fissure, barely large enough to admit the escape of the bone, to almost complete separation from their osseous attachments. The capsular ligaments are usually more extensively torn than the band-like, and, in both cases, shreds of the injured structure are occasionally interposed between the bone and the parts upon which it rests. In dislocations from muscular contraction, as in those of the

jaw and shoulder, slight laceration of the ligaments is generally conjoined with marked elongation, and dissection has rendered it probable that cases of this kind occasionally occur even without any rupture whatever. The muscles in the immediate vicinity of the injured articulation usually participate, at least to some extent, in the mischief sustained by the ligaments; being, like them, more or less stretched, contused, or even lacerated, though the latter occurrence is commonly neither frequent nor extensive. The nervous trunks around the joint may be compressed and displaced by the luxated bone, but are rarely, if ever, torn, or seriously hurt in any way. The same is true of the larger vessels, both arterial and venous, the hemorrhage which follows the accident, and which is usually quite small, proceeding from the smaller ligamentous, cellular, and muscular branches. If the patient has survived the accident several days, so that the parts have had time to become inflamed, more or less plastic matter will be found, both in the socket and in the neighboring tissues, matting and gluing them together.

Prognosis.—The prognosis of simple dislocations must be considered with reference to two circumstances, the restoration of the displaced bone, and the severity of the injury sustained by the accident. If attended to early, they may commonly be easily reduced, and are seldom dangerous either to life or limb. If, however, they be neglected, or improperly managed, more or less deformity, and loss of motion must ensue, and the resulting inflammation may be so great as to cause serious constitutional disorder. Luxations of the orbicular joints are generally less hazardous than those of the ginglymoid, but they are nearly always more difficult of reduction, on account of the adjacent muscles being more numerous and powerful, and, consequently, more resisting. On the other hand, however, the displacements of the orbicular articulations retain their reducibility much longer than the ginglymoid; thus, a luxated shoulder may often be restored at the end of several months, whereas a luxated elbow generally becomes irreducible within as many weeks. In children, old persons, and females, the restoration is generally more easily accomplished than in adults, or in strong, robust individuals, whose muscles are more developed, and, therefore, less easily subdued. This difference obtains, in the same relative degree, even when anæsthetics are used.

Treatment.—The leading indications in the treatment of simple luxations are, first, to return the articular surfaces as soon as possible to their natural situation; secondly, to keep the affected joint at rest until the lacerated ligaments and other structures have become repaired; thirdly, to limit and subdue inflammation; and, fourthly, to restore the functions of the parts. The nature of these indications, and the mode of fulfilling them, should be kept clearly and prominently before the eye of the practitioner in every case of dislocation that may happen to fall under his observation and treatment; for unless he has accurate and definite conceptions upon the subject, he must often fail in accomplishing his object in a satisfactory and creditable manner.

In entering upon the consideration of the treatment of this class of

accidents, the first question that arises is, what are the causes which oppose the reduction of dislocations, or, in other words, why is it that dislocations do not disappear of their own accord? Until recently it was generally supposed that the principal barrier to the reduction was the resistance offered by the muscles connected with the displaced bone, contracting at first spasmodically, and then permanently, so as to hold the part firmly in its new position. To overcome this action of the muscles in the vicinity of the affected joint has, therefore, always been a leading indication in the attempts at reduction; and yet how signally these attempts frequently fail, after the most thorough relaxation, not only of these muscles, but of the whole system, by the lancet, tartar-emetic, and the warm bath, is well known. This fact of itself, then, is sufficient to prove that, although muscular contraction is one of the main agents which oppose the reduction, yet it is not by any means the only, nor always even the principal, one. If the difficulty depended merely upon the resistance of the muscles, whether spasmodically acting or temporarily shortened, the use of depressants and anæsthetics, aided by steady, persevering extension and counter-extension, ought to enable the surgeon to reduce, promptly and effectually, every dislocation whatever that may come under his notice. But this is not the case; the patient, in former days, used to be bled to syncope, nauseated to the utmost with tartar-emetic, and literally parboiled, and yet, half dead as he was, restoration was frequently impossible, and so it is still in these days of chloroform and ether. This, then, being the fact, we must seek for other opponents, capable at least of aiding the muscles in their resistance, or of themselves sufficient to offer a serious, if not insuperable, barrier to the reduction. Such obstacles are found in the bones and ligaments, and but for these it would be difficult to conceive of any case of dislocation that could resist, more than a few minutes, any well directed efforts at restoration. In truth, almost every dislocation would reduce itself. Why is it that the surgeon frequently experiences so much trouble in replacing a luxated thumb? Is it not because of the resistance offered by the promi nences and ligaments of the affected joint? The muscles of the thumb can certainly not exert any serious influence in preventing the reduction, for cases have occurred where the luxated phalanx has been literally torn away in unsuccessful attempts of this kind. In dislocation of the jaw, the principal obstacle to the reduction is the zygomatic process of the temporal bone; and, although the temporal, pterygoid, and other muscles usually contract with great power, yet this would rather tend to favor the reduction than to prevent it if the condyle of the bone were not firmly locked in the fossa below. The obstacle which bony prominences offer to replacement is well shown in the luxations of the shoulder and hip, the former being always comparatively easy of reduction, on account of the smooth and shallow state of the margin of the glenoid cavity, while the latter, in consequence of the opposite state of the rim of the acetabulum, are generally comparatively difficult. This resistance, however, is always, other things being equal, most striking in the ginglymoid articulations, owing to the greater complexity of their structure, and their larger size, but more especially to

the greater number and bulk of the neighboring prominences and depressions, thus permitting the displaced bone to become more readily interlocked with the fixed one.

A serious barrier to reduction is often afforded by the ligaments, caused by the small size or the peculiar shape of the rent made at the time of the accident, the bone passing readily through it, but being unable to return on account of the manner in which it is girt by the edges of the aperture; the membrane or cord being drawn over its neck like a purse with its string tightened. That this frequently happens in the capsular ligaments, in luxations of the orbicular joints, may readily be imagined when we take into consideration the difficulty of effecting reduction, however thoroughly the system may be relaxed, while, in regard to the funicular ligaments, or those of the ginglymoid articulations, the fact is abundantly attested by daily experience.

Finally, it is extremely probable that the reduction of certain dislocations is materially impeded, if not at times prevented, by the head of the displaced bone becoming entangled among the neighboring muscles or tendons, producing an effect similar to that occasioned by the ligaments and bones.

The means which are usually employed for surmounting these several obstacles, consist of certain manipulations or manœuvres, as extension and counter-extension, aided, if necessary, by pressure and thorough relaxation of the system.

Occasionally mere pressure, if properly directed, is sufficient to effect reduction, especially when the dislocation is seated in a joint with loose ligaments, or when the ligaments are extensively lacerated and the neighboring muscles are in a passive, crippled, or paralyzed condition. In general, however, more or less extension and counter-extension will be required, and the mode of applying and conducting these becomes therefore a matter of paramount consequence. Upon these subjects much diversity of sentiment has existed among writers, some contending for one mode of practice, and others for another, as though it were possible to lay down any specific rules upon points of treatment which must necessarily vary according to the exigencies of every particular case. My own experience has led me to conclude that it is generally best to apply the extending power to the bone which is articulated with the luxated one, or, in other words, as far as possible from the site of injury. Many highly respectable authorities, however, select the distal portion of the displaced bone, under the supposition that it affords a more direct and influential leverage. In not a few instances, indeed, we are obliged to adopt this course from necessity, the nature of the case not admitting of any choice; as, for example, in dislocations of the wrist and elbow, and in the corresponding ones of the inferior extremity.

Extension and counter-extension may be made by the hands of intelligent assistants, aided, if requisite, by laces, napkins, or sheets, or by means of pulleys. As a general rule, the resisting power, or the counter-extending means, should be fully equal to the extending, and both should be applied in such a manner as to create as little inconvenience and pain as possible; they should be exerted slowly and

gradually, and at the same time continuously, the object being not to fret the muscles which oppose the reduction, but to fatigue and exhaust them. Hence any sudden and violent movements would only be followed by mischief. With regard to the extension, it should always be first made in the direction of the luxated bone, but in proportion as the resistance is overcome the limb should gradually be brought back to its natural position.

During the reduction the patient may sit up or lie down, as may be most convenient, or as the exigencies of the case may seem to demand. Whenever chloroform is administered recumbency is indispensable, for the reasons already several times mentioned. As a general rule, the patient should lie upon a bed or table during the reduction of nearly all the dislocations of the principal articulations, especially those of the shoulder, hip, and knee; in those of the elbow, hand, ankle, clavicle, and jaw, on the contrary, it will be found most convenient for the surgeon to have him sit up. The number of assistants must vary from one to three, four, or five, according to the nature of the case, and it will be of great benefit if their duties are always accurately defined before the operation is entered upon, otherwise delay, annoyance, and embarrassment will be sure to be the result. The counter-extending band, which generally consists of a folded sheet, a jack-towel, or, what is better, of a long stout piece of muslin, should be fastened round the trunk or limb so as to diffuse its pressure over a considerable space, without the risk of injuring the soft parts, exciting the muscles in the neighborhood of the dislocation, or interfering mechanically with the return of the luxated bone. The extending band must also be secured with great care. The best plan is to envelop the surface of the limb to which it is to be applied with a soft wet napkin, folded, and passed round at least twice. This answers the double purpose of

Fig. 234.

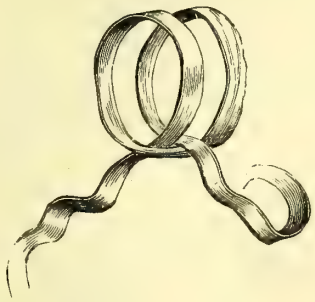
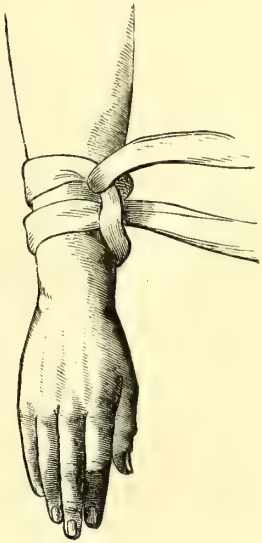


Fig. 235.

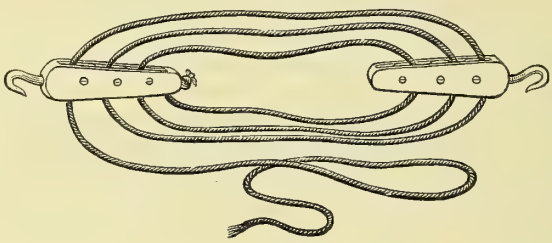


protecting the skin and of preventing the noose or lac from slipping, which seldom fails to happen if we use a dry cloth. The lac should be of sufficient strength not to break, and should be fastened round the napkin by means of the clove-hitch, or sailor's knot, the proper method of making which will be readily under-

stood from the preceding sketches (fig. 234 and fig. 235). Or, instead of this, we may use the French knot, which is equally efficient, and which is executed by placing the band across the limb so as to form a loop on each side, each end being then passed under the limb through the opposite loop. In the more simple forms of dislocation the requisite extension and counter-extension may be made with the hands, or by the pressure of the heel, knee, or fist.

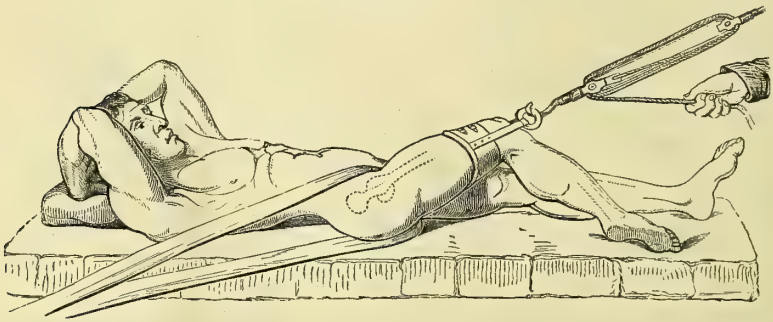
Pulleys (fig. 236) are rarely required in the present improved mode of

Fig. 236.



reducing dislocations, the use of anæsthetics and the "manual method," as it is termed, having well nigh rendered their application unnecessary in all recent cases of the accident. I have myself not had occasion to employ them for several years, and I believe that, as the profession becomes better acquainted with the nature of the subject, they will ultimately be almost entirely dispensed with. I am satisfied that they have done immense mischief, even in the hands of otherwise judicious surgeons, and that they as often impede as favor reduction. A formal description of this instrument will be unnecessary here, as its appearance and office, known to every one, will be readily understood from the annexed representation (fig. 237). During its application the patient

Fig. 237.



should be recumbent, one hook being fastened to a staple (fig. 238) in the floor or wall, and the other to the noose in the lac encircling the limb. The cord should then be tightened, either by the surgeon himself, or by a trustworthy assistant, the operation being performed with all possible care and gentleness, so as not to endanger fretting of the

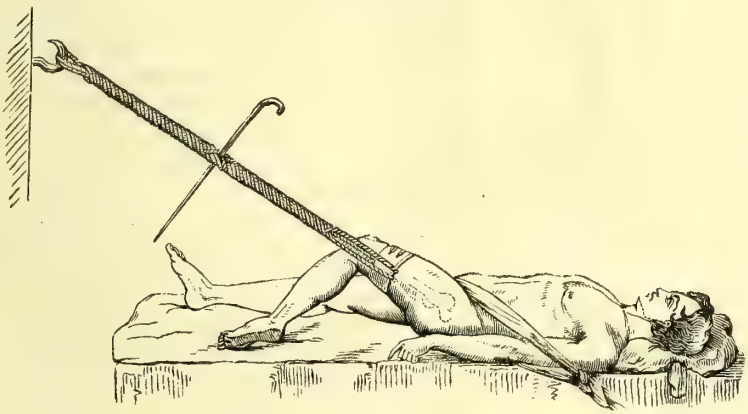
muscles, fracture of the bones, or rupture of any of the soft parts.

Fig. 238.



A very ingenious contrivance, serving as a ready and efficient substitute for the pulleys, was suggested, some years ago, by Professor Gilbert. It consists in the use of a thin but strong rope, from four to eight strands of which are passed under the extending band, and doubled upon themselves. The free extremities are then drawn tightly, and secured to a staple in the wall. A stick is next carried across the centre of the strands, and revolved upon its axis as a double lever. In this manner a single assistant may furnish any amount of power that may be necessary, gradually and steadily overcoming muscular action, while the surgeon himself attends to the dislocated bone. The annexed cut (fig. 239) affords an illustration of the apparatus, as applied to the subject.

Fig. 239.

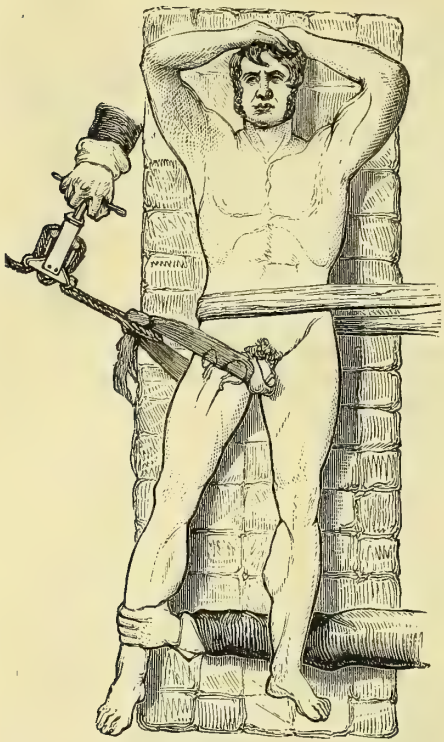


Another instrument of great power is the dislocation tourniquet devised by Mr. Bloxam, of London, represented in the adjoining cut (fig. 240), and which, although it acts upon the same principles as the multiplying pulleys, is a more convenient as well as a safer contrivance, capable of affording real aid in drawing the bone into its natural position in cases of unusual muscular resistance.

Of the surgical adjuster, invented by Dr. Jarvis, I have but little to say; I have never employed it in recent dislocations, and in the repeated trials which I have made with it in those of somewhat long standing it has not been my fortune to meet with any success. It is an instrument of extraordinary power, and should therefore be used with great care and discretion. In the hands of its ingenious inventor it has doubtless been productive of very beneficial results.

As the resistance of the muscles is one of the chief barriers to the reduction of dislocations, means, to which the term *auxiliary* is applied, are generally at once resorted to with a view to its counteraction. These means are both local and constitutional, and are particularly

Fig. 240.



necessary in strong, robust individuals. The most efficient remedies of this class, formerly at the disposal of the surgeon, were copious bloodletting, usually carried to syncope, nauseating doses of tartar-emetic, the warm bath, and full doses of anodynes. Sometimes the disgusting practice of intoxication by alcoholic liquor was pursued; and Dr. Physick occasionally advised the smoking of tobacco to bring about the desired relaxation. Since the introduction of chloroform and ether much of this practice has become obsolete, these articles having very properly taken its place. Even bleeding is now seldom necessary, except occasionally where, from the excessive muscularity of the patient, unusual difficulty is expected, or where, from the injury sustained by the soft parts, it is important to employ at once active measures for preventing excessive inflammation. Tartar-emetic, the warm bath, and tobacco have justly been proscribed. The patient is anæsthetized in the usual manner, and all manipulative action is withheld until the system is completely relaxed and the mind rendered unconscious, when the operation is to be at once proceeded with, the action of the remedy being gently maintained until the object is accomplished. I have employed this practice in every case of dislocation that has fallen under my notice during the last ten years, and have good reason to be satisfied with the result, never having failed in a single instance.

When a surgeon is called to a case of dislocation immediately after it has happened, he may occasionally succeed in effecting his purpose by taking advantage of the faint and relaxed state in which he finds the patient in consequence of the shock he has sustained. At other times, again, he may succeed by diverting the patient's attention, either by engaging him in conversation, or by a sudden expression of surprise, while he makes a forcible attempt at reduction. The mere idea of pain is generally sufficient to excite the muscles to spasmodic action, so as to oppose the efforts of the surgeon at restoration. It was therefore formerly a matter of great consequence to prevent this by a playful remark, an impertinent question, or an angry reply, calculated to distract the attention of the sufferer, and throw the muscles off their guard. Dupuytren is reported, upon one occasion, to have employed

a similar, though less polite, expedient. Having been called to a lady of rank on account of a dislocation of the shoulder, he was for a long time foiled in his efforts; the assistants pulled, he pushed and pressed, and the patient shrieked and offered every possible resistance. His temper became ruffled; he tried in vain to distract her attention. At last, said he, "Madam, I have repeatedly asked you how this accident has happened, and you have as constantly deceived me; you have not informed me that you had been drunk." The woman, shocked at the remark, indignantly asked, "Who has told you so?" "Your son, madam." The poor patient was stupefied, all the muscles became instantly relaxed, and in a moment the luxation was reduced.

As soon as the system is properly relaxed the surgeon proceeds to the reduction, trusting either to his own personal efforts, or employing such aids as he may consider the exigencies of the case to require. When the extension and counter-extension have been kept up for some time, bringing thus the head of the displaced bone gradually nearer and nearer to its socket, he should grasp the part firmly with his hands and thus assist in lifting it into its natural position. Or he may accomplish this by means of a band or fillet thrown across his neck and shoulder, while he makes strong and steady pressure against the head of the bone, pushing it back in the direction of the luxation, or towards its fellow. In many cases the reduction will be facilitated if, at the moment the bone approaches its socket, the limb be rotated upon its axis, carried towards the body, or drawn over the opposite limb. When the replacement threatens to be unusually troublesome, the ingenious surgeon will not fail to employ all kinds of expedients and stratagems to accomplish his object, rather than abandon the patient to his fate with a useless limb.

The return of the head of the dislocated bone to its natural situation is indicated by the restoration of the shape and motion of the joint; by a snap or noise heard at the moment of the reduction, but which is always very faint when the patient has been anæsthetized; and by a great and sudden diminution of pain.

Finally, it is always extremely desirable, as soon as the nature of the accident has been clearly ascertained, to effect the reduction as speedily as possible, even although there should be considerable inflammation and swelling, and, consequently, a probability of inflicting severe pain; for it is much better, I conceive, to pursue this course than to subject the patient to the risk of having, by the delay, an irreducible dislocation, of which there must always be some apprehension, especially when the injury involves a ginglymoid articulation. In making these remarks I do not, of course, mean to be understood as saying that there ought to be no exceptions to this procedure; I should certainly be very loth to attempt replacement if the parts were very tumid and painful; in such a case I should wait a few days, but only a few days, in the hope of being able, by leeches, saturnine and anodyne lotions, antimonials, and other means, to reduce the inflammation to such an extent as to render the parts more tolerant of the approaching ordeal.

In obstinate cases of dislocation, rendered so by the manner in which

the bones are interlocked with each other, and in which the muscles passing over them are stretched like tense cords, the reduction is sometimes greatly facilitated by a resort to *tenotomy*, performed of course subcutaneously. The expedient is particularly valuable in dislocation of the tarsal joints, but it may also be advantageously employed in displacement of the larger articulations, especially in those of long-standing. The operation has recently been successfully performed in a number of instances, and I am not aware that it has been followed in any by bad results.

After-treatment.—When the reduction is completed, measures must be adopted, first, to prevent a recurrence of the accident, and next to limit inflammation, more or less of which must necessarily take place after every injury of this kind, however simple. The former of these objects is accomplished by appropriate bandages, or bandages and splints, with rest in the recumbent position, especially if the injury be seated in the lower limbs; in dislocations, on the contrary, of the upper extremity, the arm should be suspended in a sling, and the patient, after a few days, may walk about in the open air. Inflammatory accession is met by the usual antiphlogistic remedies, both constitutional and topical, among the latter of which evaporating lotions, as spirits and water, and solutions of acetate of lead, along with laudanum, are the best, and they will generally be found most agreeable and beneficial, at least during the first forty-eight hours, if they be applied warm. Whenever the joint is so situated as to admit of the application of the roller, this is on no account to be omitted, as it serves both to support the parts and prevent swelling. Its effects, however, must be most carefully watched; and the first wrapping must always be very light, lest undue constriction be the result. Pain is subdued by full doses of morphia.

Finally, another object, one, indeed, of paramount importance, is to prevent anchylosis. Hence, as soon as the inflammatory symptoms are abated, passive motion must be instituted, and repeated, steadily and perseveringly, at first, once a day, and afterwards twice or even thrice, until the functions of the joint are perfectly re-established; an object which can seldom be attained, in any case, under several months, and in some, indeed, not under six, ten, or twelve, depending upon the nature of the joint, the extent of the injury, the character of the treatment, and, above all, the co-operation or want of co-operation of the patient, whose conduct has often much more to do with the production of a stiff and useless joint than his surgeon. After the more prominent inflammatory symptoms have disappeared, the absorption of effused fluids should be promoted by soap liniment, or moderately stimulating embrocations, followed, in due time, by the cold douche, dry frictions, and shampooing.

3. COMPLICATED DISLOCATIONS.

A complicated luxation, as stated elsewhere, is one where the displacement is accompanied by a fracture, the rupture of an important vessel or nerve, a violent contusion, or a wound communicating with

the cavity of the articulation, or extending deeply among the tissues in its neighborhood. Not unfrequently, several of these lesions coexist, thus materially increasing the gravity of the case, and the difficulty of managing it.

A complicated dislocation may, of course, occur in any of the articulations, but it is by far more frequently met with in those of the elbow, wrist, knee, and ankle than in any other, for the reason, probably, that the heads of the bones are less protected there by muscles, and also that they are more sharp or angular, than in the orbicular joints. Hence, when the injury is unusually violent, the articular extremities, losing their ligamentous connections, are apt to be impelled with so much force against the soft parts, as to lacerate them from within outwards, dividing muscles, tendons, fasciæ, vessels, nerves, and integument, and perhaps protruding several inches beyond the external wound; or, the vulnerating body, impinging forcibly against the external surface, may commit the mischief from without inwards, the bones being comparatively passive until the moment they are struck, when they, in their turn, may inflict additional injury upon the structures beyond where the projectile does not penetrate. In the great majority of instances, at least in civil life, the lesion is caused by falls, blows or kicks; in military practice numerous cases of complicated dislocations occur from gunshot injury.

Compound dislocations, as they are commonly called, appear to be very rare in comparison with simple. Thus, in 94 cases of dislocations, reported by Dr. Norris, as having occurred in the Pennsylvania Hospital, only 2 were compound; and of 166 cases collected by Professor Hamilton, only 8 were of this description.

Symptoms.—The symptoms of complicated dislocations are usually sufficiently characteristic, and do not, therefore, require any formal description. In general, there will be more or less distortion of the joint, inability of motion, discharge of synovial fluid, and shortening of the corresponding limb, with contusion, discoloration, and ecchymoses of the soft parts. When there is a wound, the end of the bone not unfrequently protrudes at the external opening; sometimes to the distance of an inch or two. Crepitus will of course be present when the dislocation is complicated with fracture. Great numbness and partial paralysis will indicate the division of an important nerve; while coldness of the extremity, with absence of pulsation in its distal portion, and copious extravasation of blood, will be denotive of serious injury of the principal artery.

Prognosis.—A complicated luxation, as the name implies, is always a serious injury, liable to be followed by the most dreadful consequences, jeoparding the safety both of limb and life. The resulting inflammation is generally extremely violent, and is peculiarly prone to lead to abscess, erysipelas, and pyemia, especially in persons of intemperate habits, or of a delapidated system. Under such circumstances, and sometimes even when the person was in the most perfect health just before the accident, the constitutional disturbance is generally very great, delirium sets in early, and the parts are soon seized with gangrene. The danger of mortification will necessarily always

be proportionably great when there has been a division of an important vessel or nerve, interrupting circulation and innervation; pyemia will be most likely to happen when there has been excessive shock, and necrosis when the protruded or exposed bone has been stripped of periosteum, broken in pieces, or covered with dirt. But the danger to limb and life is not limited to the primary effects of the injury; often, after an attempt has been made to save the parts, the surgeon is chagrined to find that all his efforts have been unavailing, that the patient is gradually worn out by hectic irritation and profuse discharge, and that amputation, now performed as a dernier resort, hardly holds out a single prospect of cure. A guarded prognosis, then, is becoming in every case of complicated dislocation, however simple, if such a term be applicable to such a subject.

Much of our success in these accidents will depend upon the promptness and efficiency of our treatment, or the manner in which the parts are managed during and after the reduction, which should always be effected as speedily as possible, and with as much care and gentleness as the case will admit of, the patient being fully anæsthetized. If there be any wound, the edges must be brought accurately together with strips of adhesive plaster, aided, if necessary, by suture, and smeared over with collodion, to exclude the air. Any loose splinters of bone that may be present are to be removed, care being taken not to interfere with any that are sufficiently adherent to render it probable that, if left behind, they will reunite. The fingers and forceps will be the best instruments for performing the operation. If the end of the bone protrude at the wound, it must at once be restored to its natural position, any dirt that may cover it having been previously picked away, or removed with the syringe. Should it be girt by the integuments, so as to render the reduction impracticable, a circumstance, however, which must be extremely rare, the opening must be carefully enlarged with the probe-pointed bistoury; and a similar practice should be followed when the wound is too small to admit of the easy extraction of loose fragments. If the end of the bone is very sharp, angular, or denuded of periosteum, it should be cut off with the saw or pliers, but such a step should only be taken after the most thorough conviction of its imperative necessity, for the same rule applies here as in the soft parts, to save all we can, and sacrifice nothing improperly. I can hardly conceive of a case where it would be necessary to remove the end of a dislocated bone simply because it protruded at a wound. If the patient be completely relaxed by chloroform, extension and counter-extension, with judicious coaptative pressure, could not fail to effect restoration, even when the bone is pretty tightly girt.

Finally, when luxation is complicated with fracture the rule is to reduce the former before the latter is set, for the reason that if the restoration of the joint be postponed until the broken bone is repaired, it will often be impossible to effect it. Under such circumstances, the reduction of the luxation is often greatly facilitated by putting up the fracture firmly in splints, as we thus secure a longer and better leverage.

After-treatment.—The reduction having been effected, the joint and

corresponding limb are to be enveloped in a bandage, that of Scultetus being passed round the wounded part, and placed securely in splints, or, what is preferable, in a tin case, or wooden box, in order to keep it perfectly at rest, and in as easy a position as possible. Pain and inflammation are relieved by the usual remedies; and it is here that anodynes will be likely to display their happiest effects, both in allaying suffering and in preventing serious constitutional disturbance. Antiphlogistics must be employed cautiously, with due reference to the effects of shock, long confinement, and copious drainage. In a word, the patient must not be purged and bled simply because he has a compound dislocation; on the contrary, such measures, if employed at all, must be used with the greatest possible caution. The diet must be rigidly adapted to the exigencies of the case; as in all other severe injuries it should be nutritious rather than otherwise, and cases will often arise where it should be decidedly so from the very commencement of the treatment. The enfeebled patient will often be immensely benefited by the addition of milk-punch, whiskey, ale, or porter, especially if he have been accustomed to any of these articles previously to the accident. In the event of suppuration or erysipelas, quinine will materially aid recovery, and must not be omitted.

The affected parts must be handled as little and as gently as possible; all officious interference must be refrained from; the secretions are to be removed from time to time with the sponge, and fetor must be allayed with the chlorides. In case of wound, or much discharge, the limb should be placed in bran, which will answer the threefold purpose of maintaining equable pressure, absorbing the secretions, and affording a comfortable bed for the parts to rest upon, with the additional advantage, in hot weather, of preventing the formation of maggots.

Amputation and Resection.—Concerning the propriety of amputation, the same general rules are applicable as in complicated fractures; a subject which will be duly discussed under that head. The following summary, however, will not be out of place here respecting the operation. The reasons for immediate amputation are, first, the excessive contusion and laceration of the soft parts; secondly, the rupture of the principal artery or nerve of the limb, attended with other serious injury; thirdly, an extremely shattered state of the bones; fourthly, free exposure of a large joint; and, lastly, the advanced age, depraved habits, or ill health of the patient. Secondary amputation may be required, when, after an attempt has been made to save the limb, gangrene has taken place, or life is assailed by exhausting suppuration consequent upon extensive disease of the soft parts, the joint, or bones, or of all these parts together. Very great and irremediable deformity of the limb, standing in the way of its usefulness, is also a just cause for amputation.

Instead of amputation in some of the above cases, resection may occasionally be advantageously employed, either primarily or secondarily. The primary operation is particularly indicated in dislocations complicated with a shattered and comminuted condition of the head of the displacement bone, and has been so often performed suc-

cessfully that it may now be regarded as one of the established proceedings in surgery. Its greatest success has been obtained in compound luxations of the shoulder-joint.

Even when there is no fracture of the head of the dislocated bone, but simply extensive laceration of the ligaments, completely detaching the parts from each other, it is questionable whether, in many cases, resection would not be the most expedient practice. For some highly judicious remarks upon this subject, fortified by a reference to numerous authorities, both ancient and modern, the reader may profitably consult a paper by Professor Hamilton in the American Journal of the Medical Sciences for October, 1857.

Secondary resection may be employed in caries, or caries and necrosis, of the ends of the bone, coming on after a fruitless attempt to save the parts.

4. CHRONIC, OLD, OR NEGLECTED DISLOCATIONS.

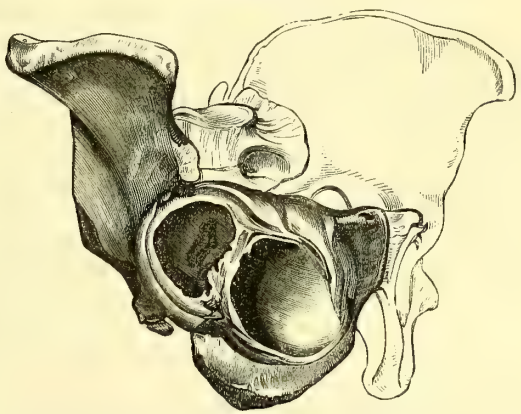
The subject of old, chronic, or neglected luxations has not received the attention which its importance merits. The morbid anatomy of these accidents is still imperfectly understood, no connected body of facts illustrative of it, having yet been published, and it is to be feared that their treatment is seldom guided by sound scientific principles. They constitute a class of cases which almost every surgeon approaches with doubts and misgivings, being anxious to do something for the patient's relief, and yet afraid lest that something shall produce serious, if not irreparable, mischief. I candidly confess that I have always shared these feelings, and that I have never had charge of an old or neglected dislocation without a strong secret wish that it had fallen into other hands, such has usually been my disappointment, and the anxiety attendant upon my efforts at reduction. The risk of rupturing an important vessel, perhaps the main artery of a limb, of breaking a bone, or of exciting extensive suppurative action in the parts around the affected joint, with the more remote chance of inducing pyemia, is well calculated to cause the practitioner to hesitate before he enters upon an enterprise so fraught with unpleasant consequences.

The blood that is effused in dislocations, unless unusually abundant, is generally very soon absorbed, just as it is after other accidents involving subcutaneous hemorrhage. Hence it is very seldom that we have an opportunity of meeting with any in chronic cases; it is only now and then that a small clot or stratum, decolorized, and partially organized, is seen, and even this is almost always eventually carried off. The inflammation consequent upon the lesion is constantly followed by a deposit of plastic matter, both in and around the joint, filling up the socket of the bone, and infiltrating the cellular tissue, muscles, and other structures in the neighborhood. More or less of this substance is also effused around the displaced head, becoming gradually organized; it renders the parts firm and rigid, thus seriously interfering with their functions. That which is poured out around the bone is at length converted into an adventitious capsule, of a pale grayish aspect, and dense fibroid texture, not unlike the pre-existing capsule,

with which it generally communicates by one or more openings, and which, by degrees, becomes wasted and attenuated from want of use. The muscles, in great measure deprived of their functions, are transformed into pale, rigid, and contracted bands, which, in time, often undergo the fatty degeneration. The periosteum, near the joint, is usually somewhat thickened, and occasionally studded with osseous stalactites. The articular cartilage lining the affected socket is generally partially absorbed, or more or less changed in its appearance, texture, and consistence, while that which invests the head of the bone exhibits a rough, scabrous aspect, being thickened at one point and atrophied at another, the osseous substance itself often becoming hard and sometimes even eburnized. Few opportunities have occurred of observing the condition of the vessels and nerves in ancient dislocations; in the cases in which this has been noticed, the former were found to be preternaturally flexuous, to accommodate them, as it were, to the displaced bone, and the latter somewhat attenuated, but otherwise sound.

In those cases in which the displaced head enjoys a good deal of freedom, it generally forms for itself a sort of socket, most commonly in a neighboring bone, (fig. 241) but sometimes in the substance of a muscle, or partly in the one, and partly in the other. This socket, however, although it may admit of considerable motion, is a very imperfect type of the original, as is also the new ligament by which it is surrounded.

Fig. 241.



Old dislocation of the hip. A new acetabulum formed; while the original is but little changed.

In addition to the changes now described, and which, it will be perceived, relate exclusively to the articular structures and to the parts immediately around, changes which are usually the more conspicuous in proportion to the duration of the dislocation, it will be found that the whole limb below the seat of the injury, and sometimes even for some distance above it, has a shrunken and withered appearance, its muscles being thin, flabby, and wasted, and its temperature materially diminished. In many cases it is affected with rheumatic or neuralgic pains, subject to aggravation with every change of the weather and with every disorder of the general health. The motion of the new joint is necessarily much restricted, and is often performed with a peculiar grating noise and sensation, caused by the roughened state of the contiguous surfaces, and the entire absence of synovial fluid. When all motion is lost the joint gradually undergoes complete bony anchylosis.

It has long been a question with surgeons at what period after the

occurrence of a dislocation it should be considered as impracticable to effect reduction. The question, as might have been expected, has been differently answered by different observers, and by the same observers for different joints. Thus, Sir Astley Cooper, who has always been regarded as the leading authority upon the subject, thought that three months for the shoulder, and eight weeks for the hip, might be set down as the limit, beyond which any efforts of this kind, except in persons of very lax fibre or advanced age, would be highly imprudent; an opinion which accords so well with general experience as, in my judgment, to entitle it to be considered as a law. It cannot be denied that this law has exceptions, but this only serves the more fully to establish its validity. Thus, in relation to at least one of the joints in question, that of the shoulder, quite a number of cases have been reported of reduction at from four to seven months after the receipt of the injury. Indeed, the late Dr. N. Smith, of New Haven, met with one where he succeeded completely nearly one year after the accident. Examples of reduction of dislocations of the hip-joint of from three to six months' standing have also occurred, although it will be found, upon careful inquiry, that their number is exceedingly small.

For the ginglymoid articulations the period is still more limited, although, in this respect, it varies a good deal among themselves. In relation to the elbow-joint, which is the best type of the ginglymoid class, I have found, in quite a considerable number of cases, that any attempts at reduction, however perseveringly or judiciously continued, will generally prove completely abortive after the third week. On the contrary, the wrist-joint may generally be rectified at a considerably later period. These differences in the reducibility of dislocations of different articulations are due altogether to peculiarities of structure and the amount of inflammation consequent upon the injury. The surfaces of the orbicular joints are comparatively smooth and simple, and their displacements are seldom followed by much inflammation; the reverse in both particulars being true in regard to the ginglymoid joints.

Evidently, then, every luxation must rest, so to speak, upon its own merits, as far as the question of its restoration is concerned; for, as has just been stated, while one joint becomes irreducible in a fortnight or a month, another, differently constructed, may remain reducible eight weeks, or even a much longer period. A much better rule by which to decide this question is to judge by the extent of motion of the affected bones, the previous attempts at replacement, and the degree of inflammation consequent upon the injury. If the joint is very stiff and tender, if the luxated head has contracted firm adhesions, involving, perhaps, a large artery, or some other important structure, and if, in addition to this, there is reason to believe that the socket is filled up with new matter, any attempt at reduction would not only prove abortive, but might be followed by very serious accidents, jeoparding limb and life. Cases in which severe injury and even death have been the consequence of long-continued and violent attempts at reduction have happened to surgeons of great experience and eminence, and

should serve as warnings to the young practitioner against the employment of undue force or protracted efforts where the prospect of success is at all doubtful.

The conduct to be observed in the reduction of chronic dislocations resolves itself into a few simple rules. In the first place, it is necessary, as an important preliminary, to prepare the part, as well as the constitution, for the operation, by the systematic movement of the joint, and by light diet and purgatives, aided, if the person be at all strong and plethoric, by at least one large bleeding. The object of this depletion is not merely to weaken the muscles, but to lessen the risk of severe inflammation and the formation of abscesses. The motion of the joint is intended to break up any abnormal adhesions that the bone may have contracted with the surrounding tissues, and should be conducted with great care and gentleness, the corresponding limb being carried about in different directions, flexed, extended, depressed, elevated, adducted, abducted, rotated, and circumducted; the operation should not be performed, at first, oftener than once a day, but by degrees it may be repeated every twelve hours, and it should be steadily continued for at least a fortnight, free use being made all along of evaporating and sorbefacient lotions, with minute doses of mercury, administered to the extent of slight ptyalism.

It does not seem to me that attention enough is usually given to this preliminary treatment. All writers speak of the importance of breaking up the morbid adhesions of the joint before the commencement of the reductive efforts, but none, so far as I know, say anything of the manner of conducting the operation and of the necessity of conjoining with it the use of sorbefacient remedies, for the purpose of promoting the absorption of the plastic material, upon which so much of the difficulty generally depends. If this point were more closely attended to, it is easy to perceive that the operation would be both more safe and more likely to be successful.

The preliminary treatment having been gone through with, and the patient being thoroughly anæsthetized, the extension and counter-extension are to be conducted in the usual manner, only with more care and patience, and with an additional number of assistants. The object is, not as in recent luxations, to fatigue the muscles, but to extend and stretch their fibres, shortened, hard and tense in consequence of long disease and inflammatory irritation. Under no circumstances should the surgeon employ violent or forcible measures, because such a procedure would not only tend to increase the resistance, and, as a necessary result, the difficulties of the reduction, but would be very likely to cause dangerous laceration of the soft parts, and secondary mischief. Should the operation fail, it must not be too soon repeated, but some time must elapse before another attempt is made, special attention being meanwhile paid to the suffering joint in the way of support and fomentation. The rupture of an important artery, as, for example, the axillary in dislocation of the shoulder, will be denoted by a rapid diffusion of blood in the connecting cellular tissue, attended with discoloration of the integuments, and the cessation of pulsation in the distal portion of the limb. The proper remedy,

in such an event, is immediate ligation of the affected vessel, and the avoidance, of course, of further interference. Should fracture occur, the operation must also at once be suspended, and the case be treated upon general principles.

In order to facilitate the reduction of old dislocations, resisting the ordinary efforts, Dieffenbach, of Berlin, many years ago, proposed the subcutaneous division of the muscles concerned in opposing the replacement of the bone, and such an operation has been repeatedly performed, though not always with the advantage that had been anticipated. I have myself occasionally employed it, but in no instance, so far as I now recollect, with any benefit. The great objection to the procedure is the danger of dividing important structures, especially large vessels and nerves, which are very often greatly displaced, and which, if injured, might occasion serious consequences. No one, therefore, should undertake such an operation unless he has the clearest possible conceptions of the anatomy of the parts, and is fully prepared to meet any emergency that his knife may produce.

5. CONGENITAL DISLOCATIONS.

There are certain dislocations which exist at birth, and which are hence denominated congenital. Their occasional occurrence, recognized at an early period of the profession, has been satisfactorily established by a number of modern observers, especially by Chaussier, Paletta, Dupuytren, Breschet, Pravaz, R. W. Smith, Guérin, and Dr. Carnochan.

Different joints are liable to this variety of luxation, but its occurrence is by far most common in those of the hip, wrist, and shoulder. The lesion is generally single, that is, limited to one side, but in some cases it is double, taking place simultaneously in the two opposite articulations. Occasionally it occurs in different joints in the same subject, as, for instance, in the shoulder and wrist, or in one of these joints and in that of the hip. Both sexes are liable to it, but by no means in an equal degree, observation having shown that females suffer much more frequently than males, in the proportion, as nearly as can be ascertained, of at least three to one. This is a very curious fact, too constant to be altogether dependent upon chance. Of twenty-six cases of congenital dislocation of the hip, noticed by Dupuytren, not above four occurred in males.

Congenital luxation is sometimes hereditary. There are several instances upon record in which it appeared in a number of successive generations, and also in several members of the same family.

Causes.—The causes of congenital dislocations have elicited much attention, as well as a great deal of controversy; but, notwithstanding this, the question, so far as its final settlement is concerned, stands precisely where it did at the commencement of the inquiry. The various theories that have been advanced in explanation of this vexed subject, may be arranged under the following heads: 1st, external violence inflicted upon the fœtus; 2dly, disease of the articulations; 3dly, arrest of development. A brief examination of these views will suffice for my purpose.

1st. There can be no doubt that undue force exerted upon the fœtus, whether from without, as when the mother receives a fall or blow upon the abdomen, or from inordinate contraction of the uterus, is capable of inducing partial dislocation of the joints, or, at all events, such a state of the articulating surfaces as to predispose them strongly to displacement. It is well ascertained that external violence is capable of producing fracture of the fœtal bones; I have myself seen one unmistakable instance of the kind, and Chaussier has recorded a case in which numerous fractures co-existed with congenital dislocations of the hip and shoulder-joints. It is extremely probable that a deficiency of the amniotic liquor may predispose to this occurrence, by enabling the womb to exert its contractile force more readily and fully upon the fœtus, thus forcing the articulating surfaces away from each other at a time when they are too imperfectly developed to resist such pressure, especially if frequently repeated. A theory of the formation of club-foot, which is probably nothing originally but a partial displacement of the tarsal joints, has, as is well known, been founded upon this supposed contractile power of the uterus, and of its injurious influence upon the fœtus. Finally, there is reason to believe that what is termed congenital luxation is occasionally produced by violence inflicted upon certain joints during delivery, in rude and forcible attempts to bring away the extremities.

2d. The second theory rests upon the idea that this affection may depend upon disease of the joints, awakened prior to the child's birth. It is extremely plausible; at all events, it is impossible not to be impressed with the conviction that it may occasionally be followed by such a result, if not directly, at any rate by inducing relaxation of the ligaments, and so favoring the action of the muscles in separating the articular surfaces. Children in the womb are, it is well known, liable to numerous affections, some of them of a highly inflammatory character, terminating at one time in death, and at another in serious and irremediable deformity. Of these affections, synovitis is one, and it is probable that it generally has a gouty, rheumatic, or syphilitic origin.

3d. The theory of an arrest of development has many advocates, both in regard to the origin of this and of other affections; but what do we know of it? Certainly nothing beyond the fact that it is expressive of the imperfect growth of a part, and of the concomitant deformity; it affords us no clue whatever to the nature of the causes that induced it, either remote or proximate. The fault may exist in the germ, or it may be superadded to it after conception, in consequence of some intrinsic defect, or as a result of the operation of causes operating through the mother.

Morbid Anatomy.—The pathological changes accompanying this lesion are numerous and diversified, having reference to the textures both of the affected joint itself and of those in the parts around. In the first place, the displaced articular extremities are generally deprived, in part, if not entirely, of their natural shape and structure, being rounded off, and divested of synovial membrane and cartilage; the atrophy of the osseous tissue is generally very conspicuous, and is

obviously the result of disease of the joint. The deepest cavity, as, for instance, the cotyloid, often completely disappears, not by being filled up with plastic matter, as in traumatic luxation, but by the absorption of its component elements. Very frequently the displaced bone forms a new socket, generally superficial, but quite sufficient for the amount of motion to which it is restricted. The ligaments are elongated and relaxed, thin, riband-shaped, partially wasted, or completely destroyed; occasionally, however, instead of being stretched and attenuated, they are very short, tense, and strong, obviously from interstitial deposits. The surrounding muscles are either atrophied, and partially transformed into fatty matter, or they are unnaturally large and stout, from the increased exercise devolved upon them by the displaced bone.

Symptoms.—The symptoms of congenital dislocation are characteristic. The affection, manifesting itself in various kinds of deformity, is noticed at, or soon after, birth, having commenced without any apparent violence; it is unattended with pain, or, if pain be present, it is much less than in the traumatic form of dislocation; the swelling also is inconsiderable, if, indeed, there is any at all; the head of the bone can be felt in its abnormal position, and the portion of the limb connected with it is generally singularly distorted, being changed in its axis, flexed, extended, or twisted. Motion is either much impeded, or too free; the affected member is commonly somewhat shortened, and more or less attenuated, from the wasted condition of its muscles. By extension and counter-extension the displaced surfaces may generally be easily restored to their proper position, but the moment they are discontinued they resume their former place. This is practicable, however, only in the younger class of subjects; in old cases, reduction is always proportionably difficult; often impossible. The deformity invariably increases with age, and is sure to be followed by an arrest of growth of the surrounding structures.

Prognosis.—The prognosis of congenital dislocation is eminently unfavorable. This is particularly true of the lesion when it is of long standing, as when the person has attained the age of puberty or of manhood, when no plan of treatment that has yet been devised can be of any material, if, indeed, of the slightest, avail, owing to the impossibility of effecting accurate adjustment of the articular surfaces, in consequence of the organic changes which they have undergone. Even under the most propitious circumstances, as it respects age and preservation of structure, the difficulties of effecting a permanent cure will generally be extremely great, well calculated to exhaust the patience both of the subject and the surgeon. The prognosis should, therefore, always be very guarded.

Treatment.—From what has just been stated, it must be evident that the sooner the treatment of this lesion is commenced the more likely will it be to be successful, or, if not altogether successful, productive of amelioration. The principles which should guide the practitioner do not differ essentially from those which govern him in the traumatic form of the accident. The two leading indications obviously are to effect reduction, and to prevent a recurrence of the displacement.

No difficulty is generally experienced in fulfilling the former, especially in very young and tender subjects; it is the latter that causes all the trouble, that annoys the patient, and frets the surgeon. Various kinds of apparatus, much of it of a very complicated and expensive character, have been devised for retaining the parts in contact after they have been reduced; but it admits of doubt whether most of it could not advantageously be replaced by more simple means, such as ordinary splints, wire cases, and adhesive strips and rollers, which might be so applied, as, in most cases, to answer the purpose most perfectly. Permanent extension and counter-extension will, of course, be required when there is retraction of the dislocated bone. Long confinement, however, should always, if possible, be avoided, as it is of paramount importance to preserve the general health. The principal local remedies, worthy of attention, are the cold douche and friction with ammoniated and other liniments, together with direct support. If the patient is feeble and anemic, benefit will accrue from the exhibition of tonics, as iron and quinine, a nutritious diet, and exercise in the open air.

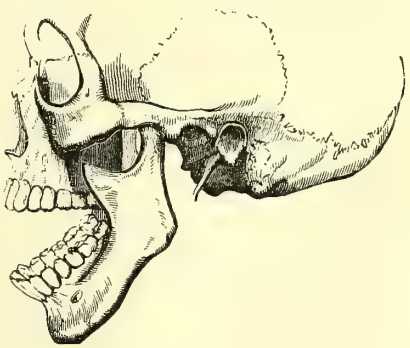
SECT. XI.—DISLOCATIONS OF PARTICULAR JOINTS.

1. HEAD AND TRUNK.

DISLOCATIONS OF THE JAW.

The connection between the lower maxillary and temporal bones is established by a hinge-joint, each condyle of the former moving upon an inter-articular cartilage, and being held in place by two ligaments. Luxation, therefore, can occur only in one direction, that is, forwards and downwards, the condyle slipping off the articular eminence of the temporal bone into the zygomatic fossa (fig. 242). The displacement is usually double, affecting both sides simultaneously, and is commonly produced by some sudden, spasmodic contraction of the muscles in fits of yawning, laughing, or vomiting, or during an attack of convulsions. Dorsey has recorded the case of a female who luxated her jaw in the act of scolding her husband. The accident has sometimes happened in an attempt to extract a tooth, to bite a large apple, or to crack a nut. Occasionally it occurs in consequence of a blow, fall, or kick upon the chin, the mouth being widely opened at the moment, and the condyle advanced forward upon the articular eminence. More frequent in women than in men, and in middle-aged and delicate

Fig. 242.



subjects than in the old and robust, it is extremely rare in young children, owing to the peculiar conformation of the body and branches of the jaw rendering the occurrence one of great difficulty.

The *symptoms* of the lesion are generally characteristic (fig. 243). The mouth is widely opened, and cannot possibly be closed; the chin is unusually prominent, and the lower line of teeth projects considerably beyond the upper; the saliva, increased in quantity, dribbles off involuntarily; deglutition and speech are performed with great difficulty; the cheeks and temples are flattened, and, as it were, elongated; the coronoid process is very distinguishable in the zygomatic fossa, especially if examined through the mouth; and, instead of the natural prominence formed by the external condyle immediately in front of the ear, there is a distinct vacuity capable of receiving the end of the finger, although with some degree of difficulty, owing to the great tension of the integuments. When the displacement has existed for some time, the symptoms, although less marked, will still be sufficiently characteristic to prevent mistake, provided the surgeon will take the requisite care to inform himself of the history of the case and the present condition of the jaw and mouth.

Fig. 243.



When the luxation remains unreduced, the jaw gradually regains a part of its motion, the dental arches approaching each other, so that eventually the patient may even be able to masticate his food; speech and deglutition also improve; the saliva ceases to dribble; and much of the disagreeable deformity disappears.

The *reduction* is effected by seating the patient upon the floor or upon a low stool, his head being supported upon the breast of an assistant. The surgeon, standing in front, introduces his thumbs, carefully defended with a piece of roller, into the mouth, as far back upon the large grinders as possible, while he places the fingers of each hand under the chin and base of the jaw. Using now each thumb as a fulcrum, he forcibly depresses the back part of the jaw, to disengage the condyles from their position in the zygomatic fossa, and at the same moment elevates the chin with his fingers, thus converting the bone into a lever of the first kind. The return of the condyles to their natural situation is generally effected by an audible snap, and the instant it is about to occur the surgeon quickly removes his thumbs from the teeth, lest, in the act of closure of the jaws, they be seriously injured by the suddenness and violence of the contraction.

Such is the mode of reduction usually recommended by writers; in

my own practice, however, I find that the operation is greatly simplified by the use of anæsthesia, which, while it completely relaxes the muscles, obviates the necessity of removing the thumbs from the jaw as the bone is sliding noiselessly into its place.

A very simple and efficient method of reducing dislocation of the lower jaw has been recommended by Mons. Nélaton. The patient being seated upon a chair, and the mouth widely opened, the surgeon, standing behind him, applies the fore and middle fingers to the mastoid process of the temporal bone on each side, and then pushes the jaw forwards by pressing against the prominence formed on the cheek by the point of the coronoid process. A small amount of force generally suffices to effect the object, the condyles slipping back into their proper situation with a distinct snap.

The older surgeons were in the habit of reducing luxations of the lower jaw by placing two pieces of cork or wood between the molar teeth, and, while using these as levers to depress the back part of the bone, they raised the chin by means of a bandage. Another method, occasionally employed by them, consisted in pressing a stick against the lower grinders, so as to keep the jaws separated until the irritated and contracted muscles, overcome by fatigue, allowed the condyles to glide into their natural situation.

In *unilateral* displacement of this bone, the chin is thrown towards the opposite side; the front teeth have lost their parallelism; the mouth is opened, but less widely than in the double luxation; speech and deglutition are somewhat impeded; and the depression in front of the ear is perceptible only on the affected side. The reduction is effected upon the same principle as in the other form of the accident, with this difference merely that only one thumb is used.

After either of these luxations, but especially the bilateral, the patient should for some time avoid opening his mouth, as the accident is extremely apt to recur from very slight causes. The safest plan, therefore, is to support the jaw with an appropriate bandage, such a one, for example, as that used in fracture. During the first few weeks the nourishment should consist exclusively of slops and other articles not requiring mastication.

In *neglected cases* of this dislocation the reduction will generally be found very difficult even as early as the end of the third or fourth week. Occasionally, however, it has been accomplished at a comparatively late period. Thus, in a case which happened to Mr. Donnavan, of Ireland, restoration was successfully effected ninety-eight days after the occurrence of the accident. Where the ordinary means fail, instead of abandoning the patient to his fate, the efforts at reduction should be aided by the subcutaneous section of the external pterygoid, masseter, and temporal muscles.

Sub-luxation.—There is a species of displacement occasionally met with in the lower jaw, which was first described by Sir Astley Cooper under the name of sub-luxation, and which depends, apparently, upon an unusual laxity of the ligaments, permitting the condyle to slip off from the inter-articular cartilage. It is most common in weak, delicate females, and is characterized by an inability to close the mouth, with

more or less pain, and a feeling of tension on the injured side. The bone generally returns of its own accord, but should this not happen replacement may easily be effected by drawing the jaw slightly forwards and downwards, so as to afford the condyle an opportunity of reinstating itself upon the inter-articular cartilage. When the relaxation of the joint is very great, the case should be treated by tonics, as iron and quinine, the cold shower-bath, exercise in the open air, and the application of a series of little blisters over the affected part.

Congenital Dislocations.—A congenital dislocation of the lower jaw has been observed in a few cases, Mr. Robert W. Smith, of Dublin, having been the first to notice such an accident, of which he has given, with great minuteness, the results of the dissection. The patient, an idiot from infancy, died at the age of thirty-eight. The luxation existed on the right side, which was remarkably deformed, having a singularly hollow appearance, which strikingly contrasted with that of the sound one, which was unusually full and plump. The extremity of the finger could be readily pressed between the posterior margin of the jaw and the external auditory canal, owing, as was found on dissection, to the absence of the condyle of the bone, which was, in fact, greatly atrophied nearly as far forward as the symphysis. There was no inter-articular cartilage, or distinct capsular ligament; and both the masseter, pterygoid, and temporal muscles were much wasted. The temporal, malar, superior maxillary, and sphenoid bones were imperfectly developed, and the glenoid cavity existed merely in a rudimentary state.

DISLOCATIONS OF THE CLAVICLE.

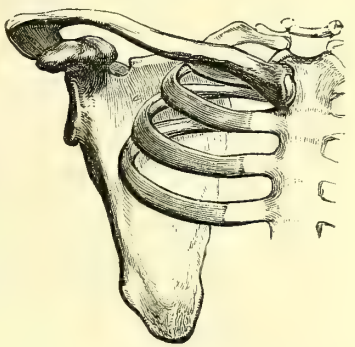
Dislocation of the clavicle, compared with fracture of this bone, is extremely rare, there being probably at least ten cases of the latter to one of the former. The cause of this remarkable difference is to be found in the exposed situation of the bone, and the great shortness and strength of its ligaments which render it much more liable to give way in its substance than at its articulations with the sternum and scapula. The displacement may occur at either joint, and there are several instances upon record where both were affected simultaneously.

1. The *sternal extremity* of the clavicle may be dislocated forwards, backwards, and upwards, the relative frequency of the accident being in the order here stated. Luxation downwards is rendered impossible on account of the resistance offered by the cartilage of the first rib.

Dislocation *forwards* is generally produced by injury inflicted upon the top of the shoulder, or by falls upon the elbow at a moment when the arm is separated from the trunk. Under these circumstances the clavicle is impelled violently forwards and inwards, completely rupturing the sterno-clavicular ligaments, and presenting itself, along with the inter-articular cartilage, in front of the upper part of the sternum. The cleido-mastoid muscle is pushed down, and some of its inner fibres are occasionally lacerated, particularly when they take their origin unusually near the joint.

The *signs* which denote the accident are, a hard, circumscribed, incompressible tumor at the upper and anterior part of the sternum, a vacuity at the natural situation of the joint, unusual prominence of the inner portion of the cleido-mastoid muscle, depression of the shoulder, and inclination of the head towards the affected side. But the most reliable evidence of the nature of the case is derived from tracing the outline of the bone with the finger of one hand, while the shoulder is moved by grasping the elbow with the other, and by recollecting that in dislocation the bone retains its normal length while in fracture it is materially shortened. The head of the clavicle overlaps the sternum, and is always directed downwards (fig. 244), so as to enable the examiner readily to distinguish the articular surface, from which it has been removed.

Fig. 244.



The *reduction* of this dislocation is effected easily enough, but unfortunately it is retained with so much difficulty that hardly any one recovers without some degree of deformity, despite the best directed efforts of the surgeon. Many years ago I had a case of this kind under my charge, which, notwithstanding the most vigilant care and attention, was as bad, as it respected the cure, at the end of three months, as it was on the day on which it happened. Since then I have seen several other examples, and the result has scarcely been more gratifying. The articular cavity of the sternum is so shallow, and the ligaments unite with so much difficulty, that it is almost impossible to keep the parts in apposition sufficiently well or long to obtain complete consolidation. Fortunately, however, this occurrence does not materially affect the movements of the shoulder, for experience has shown that these are very soon entirely re-established. It is a matter, therefore, simply of deformity, not of utility.

To reduce this luxation, one hand should be placed, shut, in the axilla, while the other grasps the elbow, which is then to be raised in order to push up the humerus, and thus convert it into a lever, acting directly upon the clavicle and scapula. The shoulder is next carried upwards, outwards, and backwards, in a direction opposite to that of its displacement, and the forearm brought forwards across the chest, so that the thumb and fingers shall rest upon the sound collar-bone. By this manœuvre the articular surfaces generally resume their natural relations, but, should this not happen, the reduction is to be promoted by pressing the luxated head of the clavicle backwards and slightly upwards. A wedge-shaped pad, with the thick end directed upwards, being placed in the axilla, the limb is firmly secured to the side and front of the chest by the ordinary fracture-apparatus, or, what is better, the adhesive-strip dressing, a stout, square compress being applied directly over the sterno-clavicular articulation. The dressing must be

frequently inspected with a view to its readjustment, and must be worn for at least three months with great constancy and regularity.

Dislocation *backwards* is generally produced in an indirect manner by injury applied to the shoulder impelling the scapula and the outer extremity of the clavicle forwards. It may also be caused by a severe blow upon the inner end of the bone, by the body being crushed between two resisting objects, and by violent traction upon the upper extremity when the trunk is firmly fixed and inclined backwards. The distinctive sign is that the head of the clavicle is forced backwards, and that it can be felt behind the summit of the sternum, sometimes below, at other times above, the level of that bone. A vacuity exists at the natural situation of the joint, the shoulder is directed somewhat forwards, the arm hangs uselessly by the side, and there is generally considerable dyspnœa, with cerebral congestion, and difficulty of deglutition, from the pressure of the luxated bone upon the trachea, cervical vessels, and œsophagus. The ligaments are completely ruptured, and the cleido-mastoid muscle is partially separated from its sternal attachments.

The *reduction* is effected upon the same principles as in the dislocation forwards, the fist being placed in the axilla and used as a fulcrum, while the shoulder is pushed upwards, outwards, and well backwards, and retained in this position by an appropriate apparatus, of which a figure-of-8 bandage with a long, thick, square compress between the shoulders is one of the best. Whatever means, however, be employed, it will be found extremely difficult to keep the articular surfaces in apposition and prevent deformity. When the reduction is unusually obstinate, as it sometimes is when the head of the bone is firmly wedged in behind the sternum, the knee should be placed between the shoulders, the affected one of which should then be drawn forcibly backwards and outwards, the arm being at the same time extended nearly at a right angle with the trunk.

This variety of dislocation is sometimes produced by deformity of the spine, allowing the shoulder to sink gradually forwards so as to push the head of the bone from the sternum. In a case of this kind which happened to Mr. Davie, of England, the clavicle compressed the œsophagus so severely as to cause great difficulty in swallowing, and danger to life by starvation. As reduction was impracticable, the trouble was remedied by sawing off the sternal end of the bone, about one inch from the articulation. The patient speedily recovered, and lived six years after the operation.

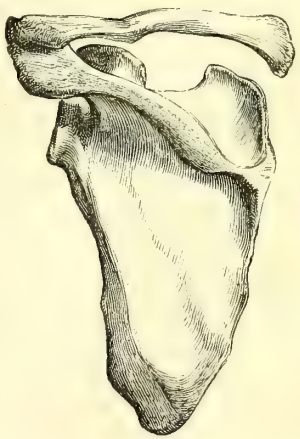
Luxation *upwards* is extremely rare; so much so, indeed, that many of the best surgeons formerly doubted the possibility of its occurrence. The cases, however, that have been reported within the last twenty years by Macfarlane, Baraduc, Malgaigne, and others, fully establish its claims to the distinction of a new species. The accident generally results from violence inflicted upon the shoulder, as a blow or fall, driving the scapula downwards and inwards towards the chest, thus separating the bone from its connections, and forcing it upwards above the fourchette of the sternum. The symptoms are usually very characteristic. The bony tumor can be distinctly felt and seen in front of

the trachea, where it is easily impressed by moving the corresponding arm; the shoulder, sunk forwards and downwards, approaches nearer to the median line than naturally; there is a remarkable interval between the clavicle and the cartilage of the first rib, amounting to from six to twelve lines; the cleido-mastoid muscle is put upon the stretch; and there is a vacuity in the natural situation of the joint, as in the other forms of the accident. The reduction is very easy; all that the surgeon is obliged to do in order to effect it, is to lift the shoulder thoroughly away from the chest, at the same time that it is slightly elevated and inclined backwards, and pressure made directly upon the luxated head. Retention is to be attempted upon the same principles as in the other sterno-clavicular luxations; a pad being placed in the axilla, and the elbow and forearm being well supported by adhesive strips and bandages. The reunion is generally imperfect, but this does not materially weaken the functions of the limb.

The clavicle is occasionally dislocated at one or both extremities, as a *congenital* vice. I observed, some years ago, a well-marked example of this accident at the sterno-clavicular articulation, in an infant three months old, otherwise perfectly healthy and well-formed. The end of the clavicle projected upwards and forwards, in a striking degree; and, although reduction could be readily effected, nothing that I could employ could keep the parts in place.

2. The *scapulo-clavicular* articulation is effected by the acromion process of the scapula and the outer extremity of the clavicle, by a species of arthrodia, the concave surface of the former being closely adapted to the convexity of the latter, and the union established by strong ligamentous bands. Admitting of hardly any motion, it can be dislocated only by external violence applied either directly to one or the other of the two bones, or indirectly through the arm and sternum. The accident is usually attended with severe contusion of the soft parts, and is seldom so thoroughly repaired as not to be followed by some degree of deformity, although the recovery of the motions of the limb is eventually sufficiently perfect for all useful purposes.

Fig. 245.



The scapular end of the clavicle may be thrown from its natural position in three different directions; upwards, above the acromion process, downwards and backwards, beneath this prominence, and downwards and forwards, under the coracoid process. Of these several luxations, the first is by far the most frequent; both the others are extremely rare.

In the dislocation *upwards*, the end of the clavicle, breaking away from its articular connections, is thrown up by the action of the trapezius muscle, or by the impelling force, so as to overlap the acromion process (fig. 245), and form a small, hard, round tumor immediately beneath the

skin, which disappears upon raising the arm, but is reproduced the moment that we let go our hold. The head is inclined towards the injured side, the limb hangs closely along the trunk, the shoulder looks as if it were somewhat flattened, and the patient is unable, without great pain and difficulty, to raise his hand to his mouth; in a word, the whole attitude of the body is nearly the same as in fracture of the clavicle. The accident is usually caused by a blow upon the shoulder, and the circumstance of the trunk being strongly impelled forwards, promotes the luxation by increasing the strain. It may also be occasioned by a fall upon the elbow, and by a kick upon the acromion process. However induced, there is necessarily, in the complete form of the lesion, a rupture not only of the acromio-clavicular ligaments, but also of the ligaments connecting the clavicle with the coracoid process. In the incomplete luxation the latter always escape.

The clavicle readily resumes its natural position by drawing the shoulders upwards and backwards, while the knee is interposed between them behind, as the patient sits upon a chair. To maintain it in this situation, the same apparatus and dressings must be used as in fracture of this bone, and in the sterno-clavicular luxations, already described. A thick pad, with the base directed upwards, is placed in the axilla, and the arm and forearm must be well secured to the chest. Direct pressure by means of a stout compress and piece of sheet lead, should be made upon the acromio-clavicular junction. Despite, however, all the precaution, care, and skill of the surgeon, he will seldom be able to procure a good cure. I have seen cases of this description treated for months with the most determined effort to succeed, and yet at the end of this time it was impossible for the patient to move his arm without causing a relapse.

Dislocation *downwards*, appropriately named *infra-acromial*, is exceedingly uncommon, only a few cases of it having been reported. The fact is, although it was described by J. L. Petit, who believed it was more frequent than dislocation upwards, it has been almost entirely ignored by modern systematic writers. It has been alleged that the accident cannot happen without previous fracture of the coracoid process, a conjecture which has been satisfactorily disproved by experiments made upon the dead subject.

The accident, in the few cases that have been carefully studied, has been the result of violence upon the shoulder, as a heavy blow, or a kick from a horse, and it can hardly be imagined that it could be produced in any other manner. It is probably attended, in every instance, with a rupture of the coraco-clavicular ligaments. The characteristic sign is the situation of the end of the clavicle beneath the acromion process, which is at the same time remarkably prominent, and somewhat nearer to the sternum than in the natural state. The shoulder is flattened, and the arm, applied close to the side, is incapable of voluntary motion. Where the evidence is so distinct, error of diagnosis must be impossible. Should any doubt, however, arise upon the subject, it may easily be dispelled by tracing the outline of the two bones as far forwards as their articulation; the finger, as it approaches this point, will at once detect the extraordinary prominence of the one, and

the marked depression of the other, and so reveal the true nature of the accident.

The *reduction* is accomplished by pulling the shoulder outwards and backwards, the knee resting against the dorsal portion of the spine, and the elbow being carried across the chest, to afford greater relaxation to the muscles, and convert the humerus into a lever for acting more efficiently upon the acromion process. Retention is effected in the usual manner, with the additional precaution of preventing all motion of the inferior extremity of the scapula. A perfect cure may be expected in from five to eight weeks, both as it respects the absence of deformity and the recovery of the functions of the limb.

Dislocations forwards and downwards, beneath the coracoid process —the *infra-coracoid* form of the accident—has only recently taken its position in surgical nomenclature. The lesion, like the preceding, is infrequent. Malgaigne states that he is acquainted with only six cases, of which not less than five are said to have occurred in the practice of Mons. Godemer, of Mayenne. If this be true, the accident must be much more common than is supposed, which, however, I doubt. A fall upon the anterior surface of the shoulder appears to be the usual cause of the accident.

The *symptoms* are unmistakable. Besides the contusion and discoloration common to all these luxations, the acromion and coracoid processes are unusually prominent; the top of the scapula is strongly inclined downwards and forwards, and there is a marked depression in the natural situation of the clavicle, which, upon being traced with the finger, is found to be directed outwards and downwards, its extremity being actually lodged in the axilla. The arm can be moved in every direction, except upwards and inwards.

The *reduction* is easily effected. The chest being firmly fixed with a strong napkin, an assistant seizes the arm, and, converting it into a lever, uses it for forcibly pushing the scapula outwards and backwards, while the surgeon himself, grasping the clavicle, disengages it from its position beneath the coracoid process, and restores it to its natural situation. The retention is maintained by the usual apparatus. The cure is generally satisfactory.

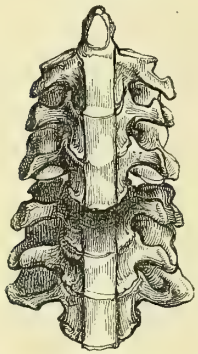
Seeing how difficult it is to keep these various dislocations of the clavicle reduced, I should not hesitate, if an opportunity arose, to fasten the ends of the bones with a silver wire, inserted subcutaneously, and retained until reunion occurred. The operation could be easily executed, and would not be likely to cause any bad effects.

Double dislocation of this bone has been observed, so far as I know, only in one instance. The case has been reported by Porral, and is said to have occurred under the care of Gerdy, in the St. Louis Hospital, in Paris. The accident was caused by a fall from a third-story window, upon the upper and back part of the shoulder. The symptoms were well-marked, the acromial end of the bone being luxated backwards and upwards, the sternal upwards and forwards. The treatment was by Desault's well-known, but now obsolete, apparatus, aided by large graduated compresses over the affected joints. Under this dressing, the outer extremity of the clavicle soon became firmly united, but the other continued obstinately displaced.

DISLOCATIONS OF THE SPINE.

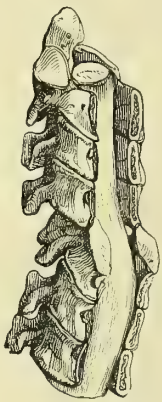
The vertebræ are so firmly connected to each other, and, excepting those of the neck, admit of such limited motion, that any injury directed against them is much more liable to break than to luxate them. Even in the cervical region, where the mobility is much greater than anywhere else among these bones, the accident is exceedingly uncommon, and it is fortunate that it is so, since it is almost always fatal, owing to the violence inflicted upon the spinal cord (figs. 246 and 247),

Fig. 246.



Dislocation of the spine, between the fourth and fifth cervical vertebræ. The cord was torn, the paralysis being complete, and death occurred in a few days.

Fig. 247.



The same; seen laterally.

causing death not unfrequently on the spot, or, at all events, within the first few days. When the patient survives the more immediate effects of the dislocation, he is very apt to perish from inflammation of the spinal cord and its envelops, at a period varying from a few weeks to several months. Hence, whether the accident be considered with reference to its primary or secondary effects, our prognosis must be equally guarded, few persons, under any circumstances, recovering. In a dislocation of the sixth and seventh cervical vertebræ, which was under the charge of Dr. Willard Parker and myself, many years ago, death occurred in less than forty hours; the patient was a young man, a circus rider by occupation, and the accident was produced while he was engaged in tumbling in the pit; it was instantly followed by paralysis of all the extremities, and he gradually fell into a state of unconsciousness, which lasted till he expired. The neck was stiff and painful, but there was no sign of displacement. On dissection, we found the articulating processes and bodies of the sixth and seventh cervical vertebræ completely detached from each other on the right side, but on the left the processes were still slightly adherent, while the connection between the bodies of the bones was perfect, although in a high state of tension. The two contiguous spinous processes were completely severed. There was no fracture. The spinal cord was

sensibly compressed by the partial rotation of the seventh vertebra, and there was a slight effusion of blood in the spinal canal at the seat of the injury.

The above case is a good type of the effects which usually follow dislocations of the vertebræ. When the lesion occurs above the origin of the phrenic nerve, death is often instantaneous from stoppage of the respiration; but if it is seated farther down, the patient may live for some time, and even eventually recover, although such a contingency is an extremely remote one. The diagnosis is generally very obscure, it being usually impossible to determine whether the accident is a dislocation or fracture, or a combination of both, while the treatment must, of necessity, be altogether empirical. The principal symptoms are paralysis of the extremities, tympanitis, obstinate constipation, and retention of urine, which soon becomes loaded with phosphates, causing inflammation and ulceration of the bladder. If the patient survives any length of time, severe bedsores are apt to form upon the nates and other parts of the body, thus greatly increasing his suffering.

As it respects the reduction of these dislocations, it is impossible to prescribe any regular or methodical course of procedure. Most practitioners, dreading interference on account of the danger of sudden compression of the spinal cord, and the consequent destruction of the patient, are in favor of allowing the parts to take care of themselves, hoping, with judicious management, for gradual recovery. Such a plan, it seems to me, is both wise and proper, at least in most of the cases that come under our observation, especially those in which it is impossible to determine the diagnosis, or where the symptoms, although well marked, are not at all urgent, the patient having a tolerably good use of every part of the body, save the one immediately implicated in the mischief. Under such circumstances, time and a "masterly inactivity" will often accomplish more than all the interference of the best surgeons. But there are exceptions to every rule, and, while I would recommend that most cases of this kind should be let alone, I would strongly advise an opposite conduct where, the symptoms being well marked, and the danger urgent, there is reason to believe that the patient will, if not relieved, speedily perish. In such a case I should consider any attempt to save him, however desperate, justifiable and proper. If we succeed, we obtain a victory; if we fail, we can but hasten an event otherwise inevitable. A number of instances are upon record where the reduction has been performed successfully. Dr. James R. Wood, not long ago, safely reduced, by manipulation, a partial dislocation of the cervical vertebræ in a child; and Dr. Ayres, of Brooklyn, more recently, happily succeeded in a case of complete luxation of these bones ten days after the accident. The patient, a tall, muscular man, aged thirty, had been violently struck on the back of the neck, the anterior portion of which was found to be remarkably convex from the blow, bulging forwards, and lifting up the larynx. The head, as the man sat in his chair, was thrown backwards and permanently fixed, the face being turned upwards. The posterior part of the neck exhibited a sharp, sudden angle at the junction of the fifth and sixth cervical vertebræ, around which the integuments lay in folds.

It was difficult to reach the bottom of this angle, even with strong pressure of the fingers, and of course the regular line formed by the projecting spinous processes was abruptly lost. The patient complained of intense pain at this part; he swallowed with much difficulty, and the breathing was obstructed and somewhat labored; but there was not the slightest paralysis or diminution of sensation. The reduction was effected by means of the hands of the surgeon and of two assistants, applied to the chin and occiput, and then used to draw the head, at first, directly backwards, then upwards, and finally forwards, counter-extension being made with two folded sheets stretched obliquely across the shoulders. The system was completely relaxed by chloroform, and the bones were distinctly felt slipping into their natural situation. No unpleasant symptoms followed, and, at the end of a week, the man had the complete use of his head and neck.

A few cases of traumatic luxation of the *occipito-atloid* articulation have been reported, but I know of no instance in which it did not promptly prove fatal. The accident had been regarded by most writers, until recently, as impossible, on account of the firm connections and restricted motions between the two bones.

A slow species of displacement occasionally occurs here in children and youths, in consequence of scrofulous disease of the articular surfaces and body of the atlas, or of this bone and some of the other vertebræ. Several examples of it have come under my personal observation, and the subject has been well discussed by Schupke and other German writers. The severe local suffering produced by the malady is to be allayed by rest and recumbency, leeches, blisters, and issues, especially those made with the actual cautery, while the constitution is to be improved by tonics and alterants, as quinine and iron, and the different preparations of iodine. When all disease is arrested, the patient may exercise in the open air, the neck and head being well supported by an appropriate apparatus.

The *atlo-axoid* articulation, enjoying a much wider range of motion than the preceding, is more liable to luxation by external violence, the most common causes of which are blows upon the back part of the head, forcible torsion of the neck, tumbling, and standing on the head, eventuating in rupture of the ligament of the odontoid process, and the projection of this process against the spinal cord, inducing fatal compression. Lifting children up by the occiput and chin, in play, is said to be capable of producing this accident; and as an illustration of the fact reference is generally made by authors to the memorable case related by J. L. Petit, of a little boy, who, being thus raised up in the air, struggled so violently as to dislocate his neck and die on the spot. The nature of the lesion may be suspected when, in consequence of a sudden twist, blow, or wrench, the head is turned to one side, and cannot be brought back to its natural position, the cleido-mastoid muscle being relaxed, and the part exquisitely painful. Unconsciousness usually succeeds the occurrence, and the patient, if not promptly relieved, soon expires. When the symptoms are urgent, an immediate attempt should be made to reduce the dislocation by inclining the head towards the side to which it is directed in order

to disengage the articular processes, a most hazardous step of the operation, and one which may instantly cause death by compression of the spinal cord. The process being liberated, the head and neck are brought to their natural position by rotating them in a direction contrary to that in which the luxation occurred.

DISLOCATIONS OF THE RIBS.

Dislocations of the *costo-vertebral* articulations from external injury must be extremely rare, if, indeed, they are not altogether impossible. That this is true any one may satisfy himself by inspecting the mode in which the ribs are connected to the vertebræ; the ligaments are both numerous and powerful, and, besides, each joint is protected by a great thickness of muscle, so that these bones, instead of yielding at their junctions, will be much more apt to give way in their continuity. The possibility, however, of the accident was not only admitted, but strenuously maintained, by many of the older surgeons, especially by Paré, Barbette, Platner, and Heister, in whose works may even be found an account of what they regarded as varieties of the lesion. But modern experience is entirely opposed to such a conclusion; in truth, there are altogether not more perhaps than half-a-dozen well authenticated cases of dislocation of the costo-vertebral articulations upon record, and in nearly every one of these the injury was associated with fracture of the ribs, or of the ribs and spine; all proved fatal, and in none was it possible to make a satisfactory diagnosis during life. Such an accident must, therefore, be entirely beyond the resources of surgical art; even if it were possible to detect the nature of the affection, still it would be impracticable to remedy it, except upon general principles, any direct interference being out of the question.

Dislocation of the ribs from their cartilages, and of the latter from each other, and from the sternum, is also a rare occurrence, though not as much so as displacement of the costo-vertebral articulations. I have myself seen several cases of the kind, one of which I attended, some years ago, along with Dr. J. R. Pirtle, the patient being a man, aged sixty, who fell from a scaffold, a distance of ten feet, upon the stone steps below, his left shoulder and chest receiving the blow. Immediately after the accident there was violent dyspnœa, and the patient stated that he could both hear and feel at every inspiration, something snap and jerk in his side, similar to the noise caused by pulling a finger-joint. Upon examination, this was found to proceed from a dislocation of the cartilages of the last three ribs from the sternum, playing to and fro during the movements of the chest. A fracture also existed in the left clavicle. In another instance the third and fourth ribs on the right side were severed from their cartilages. The remarkable case related by Charles Bell, in his surgical observations, in which all the ribs were dislocated from their cartilages by the thorax being violently compressed between a wall and the beam of a mill, is familiar to every surgeon. Occasionally the costal cartilages are separated from each other.

Whatever form these costal dislocations may assume, their existence

necessarily implies the infliction of severe injury, which cannot fail to tell badly upon the soft parts, both externally and within the chest, and to be followed, when it is not immediately fatal, by violent inflammation. Hence, besides the attention required by the local mischief, great care is demanded on account of the state of the system; in the first instance, to bring about reaction, and, secondly, to moderate the resulting excitement by the interposition of appropriate antiphlogistics. The topical treatment is by bandage and compress, as in fracture of the ribs, the patient being compelled to breathe chiefly by the aid of the diaphragm.

DISLOCATIONS OF THE PELVIS.

Notwithstanding the great extent of the *sacro-iliac* surfaces, and the vast strength of the ligaments by which they are connected together, observation has demonstrated that they may occasionally be displaced along with the pubic symphysis, by external violence. Dr. Thomas Harris, of this city, many years ago, met with a case of dislocation of these bones, in a woman, aged thirty-five, from a blow upon the sacrum inflicted by the husband's fist. In general, however, a much greater degree of force is necessary to produce such an accident; hence there must almost always be more or less contusion of the soft parts, both externally and internally, extensive ecchymosis, concussion of the spinal cord, injury of the sacral nerves, and fracture of some of the pelvic bones, thus seriously, if not fatally, complicating the case. Even when the patient survives the immediate shock of the accident, he is very apt to perish from the subsequent inflammatory and suppurative irritation, perhaps weeks after the primary effects have passed off.

Violent kicks or blows, and compression of the body between two hard and resisting objects, as a wall and a carriage, are the usual causes of this dislocation. The displaced bone is thrown backwards and upwards, forming a distinct prominence beneath the skin, easily perceptible by sight and touch, and attended with marked crepitation. The limb of the affected side is shortened and powerless, the crest of the ilium is raised beyond the natural level, the fold of the nates is flattened, the tuberosity of the ischium is higher than that on the sound side, and the ramus of the pubic bone lies somewhat posterior to the plane of its fellow. The parts are contused and exquisitely painful, and the patient is unable to lie upon his back, or to void his urine.

In the *treatment* of this luxation, the most important object, that upon which the safety of the patient mainly depends, is to prevent the ill effects of inflammation. To accomplish this, he must be kept perfectly at rest, and be subjected to the most strict antiphlogistic course, of which leeching, anodyne fomentations, and blisters, form a most valuable constituent. When the inflammation has been well reduced, the parts should be covered with an ammoniac and mercurial plaster. The reduction, which is easily effected by pressure, is maintained by a compress and broad bandage, secured, if necessary, by thigh and shoulder straps. Great attention must be paid to cleanliness, as defe-

cation will be both painful and inconvenient, and the urine must be regularly drawn off with the catheter. In a case mentioned by Hoin, the articular surfaces refused to come together until after the patient had begun to walk about, when the weight of the limb drew them gradually in place.

The *pubic symphysis* is sometimes wrenched open by external violence, as I have witnessed in two cases in persons whose bodies had been crushed between a railroad car and the edge of the floor of a depot. The accident is generally fatal, not so much on account of the injury done to the joint and bone as in consequence of the violence sustained by the contents of the pelvic cavity. The treatment must be conducted upon the same principles as in dislocation of the sacro-iliac symphysis.

A separation of this joint occasionally occurs during utero-gestation, in consequence of softening of its fibro-cartilage, allowing the two bones to ride slightly upon each other. A case of this kind was under my observation not long ago. The woman was in her fifth pregnancy, and the dislocation, beginning about a month before her confinement, was so great that she could not walk, or turn in bed, without extreme distress. The parts were exquisitely tender on pressure, and upwards of five weeks elapsed after parturition before they regained their healthy condition. Rest, recumbency, and leeches constitute the proper treatment, aided, when the patient is able to move about, by a belt with a pad on the pubes.

The *coccyx* may be dislocated from the sacrum by external violence, as a fall, or kick, or by the pressure of the child's head in difficult parturition. The bone is usually thrown forwards or backwards. In a case recently reported by Dr. Roeser, it was displaced laterally, being torn away from the sacrum, and carried over towards the descending branch of the left ischium, where it formed a small but distinct tumor. The signs of the accident are preternatural fixedness of the coccyx, with considerable shortening, difficulty in voiding the feces, tenesmus, and retention of urine. Reduction is effected by introducing the index and middle fingers of one hand into the rectum, while by the assistance of the fingers of the other, applied externally, the bone is pushed into its proper position. Rest, fomentations, and leeches will be required during the after-treatment. The bowels should not be moved for a number of days, and then only by means of saline cathartics and enemata, as all motion and straining would interfere with the reparative process, and might even reproduce displacement.

2. SUPERIOR EXTREMITY.

DISLOCATIONS OF THE HAND.

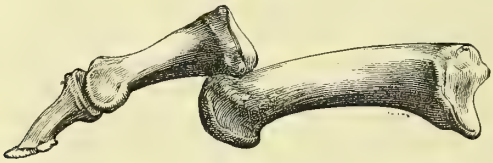
Dislocations of the *thumb*, especially of its metacarpo-phalangeal joint, are, in many respects, so peculiar as to require separate consideration. Displacement of the phalanges backwards is by far the most common, the disposition of the articular surfaces, and the ligaments by which

they are connected together, rendering luxation forwards or laterally extremely difficult.

Luxation of the metacarpo-phalangeal joint, although not of frequent occurrence, has attracted much attention on account of the difficulty of its reduction, the true nature of which can hardly be said to be even yet perfectly understood, notwithstanding the numerous researches that have been made to elucidate it. Much that has been written upon the subject must be considered as purely speculative, but still a good deal of new light has been thrown upon it by the experiments and dissections of Pailloux, Lawrie, Vidal, and Malgaigne.

In this accident the head of the first phalanx is thrown backwards upon the dorsal surface of the metacarpal bone (fig. 248), generally in consequence of violence applied to the palmar surface of the thumb,

Fig. 248.



Dislocation of the first phalanx of the thumb, backwards, on the dorsum of the metacarpus.

while the joint is immoderately extended. The metacarpal bone being thus impelled by the weight of the body, and the proximal phalanx by the object it strikes against, causes the ligaments to give way, and the articular extremities to glide past each other. It has been asserted that, when there is inordinate relaxation of the ligaments, mere muscular action is capable of producing the displacement, but the possibility of the occurrence, especially in its complete form, may well be questioned.

The dislocation is attended with great deformity, which is so peculiar that it may be regarded as characteristic. A large tumor, hard and circumscribed, and formed by the head of the first phalanx, exists upon the back of the joint, while another, equally hard, but not quite so distinct, is perceptible on the palmar aspect of the thumb, representing the distal extremity of the metacarpal bone; the thumb is sensibly shortened, and can generally neither be bent nor extended, its last phalanx, however, being usually flexed in consequence of the excessive tension of the tendon of the long flexor muscle. In most cases, the head of the first phalanx will be found to rest upon the posterior and inner part of the metacarpal bone, and not, as is commonly supposed, altogether upon its dorsal surface, and it is owing to this fact that the thumb looks as if it were rotated a good deal inwards. The shortening of the member often amounts fully to one inch, thus giving it a stumpy, characteristic appearance.

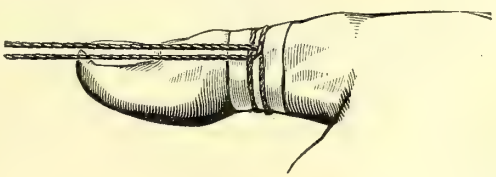
If a *dissection* be made of the affected parts, the ligaments will be found to be extensively ruptured, particularly the anterior; the extensor tendons are pushed backwards, and strongly stretched; and the external head of the short flexor muscle is torn in two, allowing the

end of the metacarpal bone to pass completely through its fibres. The anterior ligament remains attached to the sesamoid bones and the first phalanx, the latter of which, as it is thrust backwards during the accident, carries both along with it, so as to deposit them, as it were, between its anterior surface and the contiguous surface of the metacarpal bone. In this way a partition is formed by these parts between the two bones, extending back some distance, and constituting, as Mr. Lawrie justly remarks, a serious mechanical obstacle to replacement.

The *reduction*, as just stated, is generally difficult, and the means formerly employed to effect it were often so severe as to inflict the most dreadful injury, sometimes followed by extensive erysipelas and even mortification. Instances, in fact, were not wanting, though fortunately they were few, of the thumb being dragged off during violent and long-continued efforts at restoration. In many cases, again, all efforts of the kind proved unavailing, and the parts were obliged to be left in the condition into which the accident had thrown them. Desault, in order to accomplish his purpose, in difficult cases, suggested the idea of making an incision behind the extremity of the dislocated bone, and raising it out of its position by means of a suitable lever; and Evans went so far as to propose its removal altogether by excision. Charles Bell, on the other hand, attempted to remedy the evil by the subcutaneous section of one of the lateral ligaments, an operation which has frequently been performed successfully both in this country and in Europe. Sir Astley Cooper advises, after a fair trial of the ordinary means, an abandonment of the case, under the idea that the patient will eventually have a useful thumb without reduction. I allude to these views simply because they serve to show the great difficulty which so often attends this dislocation, and the harsh expedients that have been suggested for overcoming it.

The most common method of effecting replacement is that by extension and counter-extension, employed upon the same principles as those which regulate their application in dislocations of other joints. It has always answered admirably in the few cases of the accident that I have had to treat. The extension should be made by means of the clove-hitch (fig. 249), secured over a wet cloth, or piece of buckskin,

Fig. 249.

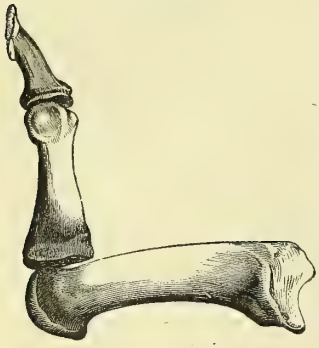


to protect the soft parts, and the counter-extension with a stout silk handkerchief, the fold resting in the palm of the hand, while the ends, crossed behind the wrist, and brought around the front of the forearm, are held by an assistant. In this way the two forces can be applied with great effect, in a line with each other, and without the risk of unduly exciting the muscles concerned in the displacement. After

they have been in operation for a short time, the thumb should be inclined inwards, in a semi-circular direction, towards the ulnar margin of the hand, at the same time that the dislocated head is urged forwards and downwards by the surgeon's own thumb. Powerful extension may also be made by means of Dr. Levis's apparatus and Charrière's forceps.

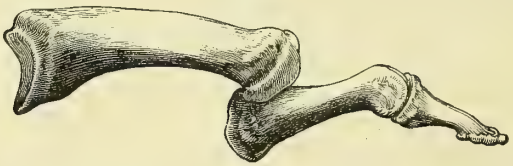
Although the method now described will, I am satisfied, generally suffice for the reduction, yet, if I should ever again be called to a case of the kind, I should at once adopt the excellent plan first practised in 1826 by Professor Crosby, of New Hampshire, and since recommended by Mons. Gerdy, of Paris. It simply consists, as the adjoining cut (fig. 250) clearly exhibits, in pushing the phalanx back, until it stands perpendicularly on the metacarpal bone, when, by strong pressure directed against its base, from behind forwards, it is readily carried by flexion into its natural position. An elaborate account of this method will be found in the American Journal of the Medical Sciences, for April, 1858, by Dr. Cutter, of Massachusetts.

Fig. 250.



The annexed sketch (fig. 251) exhibits a plan of the dislocation of the head of the phalanx of the thumb forwards towards the palm of the

Fig. 251.



hand. As already stated, it is an occurrence of great rarity. The symptoms are characteristic.

Dislocation of the *trapezio-metacarpal* joint may occur in four different directions, the end of the metacarpal bone being thrown off from the articular surface backwards, inwards, forwards, or outwards; the first two forms of the accident, however, are by far the most common, as will be apparent from an examination of the structure of the articulation and the arrangement of the muscles stretched along its anterior and outer surface.

Luxation *backwards* is always occasioned by external injury, as a blow or fall upon the dorsum of the thumb, or the extremity of its metacarpal bone, by which the latter is suddenly and violently turned towards the palm. The signs of the accident are characteristic. A hard prominence is seen and felt upon the back of the trapezium, or at the posterior and radial surface of the hand, formed by the displaced head of the bone, and the thumb is in a forced state of flexion, without

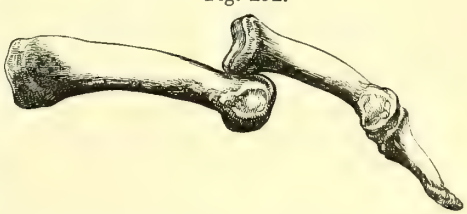
the possibility of being extended. The reduction is effected by an assistant fixing the hand, by grasping the wrist, and, while another pulls the thumb with a clove-hitch, the surgeon pushes the head of the bone forwards and downwards towards the palm, into its natural position. For some days the hand should be supported upon a broad splint, and means employed to moderate inflammation. I have occasionally seen a partial dislocation of the metacarpal bone of the thumb backwards from inordinate relaxation of the ligaments. The occurrence is most common in weak, delicate women, and requires tonics, with the cold douche and a series of small blisters, for its relief.

In the luxation *inwards*, which is exceedingly infrequent, the metacarpal bone of the thumb is wedged in between the trapezium and the head of the metacarpal bone of the index-finger, so as to extend the thumb, and cause the trapezium to form a projection at the outer and back part of the palm. In the reduction the extension and counter-extension are conducted as in the preceding case, but they have to be kept up a longer time, and, as the head of the bone approaches the trapezium, the thumb is to be inclined towards the inner side of the hand, in order to relax the flexor muscles.

DISLOCATIONS OF THE FINGERS.

The phalangeal joints are susceptible of luxation backwards (fig. 252), an occurrence which can only be caused by severe force, and which is always so well characterized as to render any description of its signs unnecessary. The reduction is effected by extension and counter-extension, aided by pressure upon the head of the displaced bone. The accident is extremely rare. Not long ago, I had a compound dislocation of the last joint of the right middle finger, in a stout, healthy man, in consequence of a fall from a hay-loft, in which he struck the end of the finger violently against the ground. The distal phalanx lay upon the posterior surface of the middle one, a large wound existing in front. The reduction was easily effected, and the parts being well approximated by suture and collodion-plaster, I indulged the hope of a good cure. Presently, however, severe inflammation set in, terminating in necrosis of the two bones, and I was obliged to amputate the finger just behind the joint.

Fig. 252.

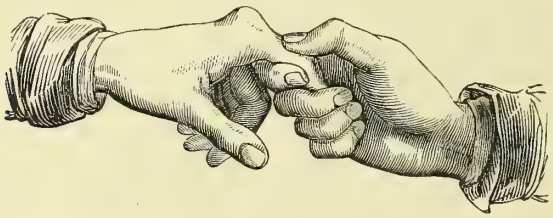


Dislocation of the *metacarpo-phalangeal* joints is also very uncommon, although not so much so as of the joints of the fingers. The phalanx is usually displaced backwards, its extremity resting upon the posterior surface of the metacarpal bone. Of the luxation forwards I have seen but one case, and that was of many years' standing; the finger was considerably shortened, and stood out in an extended position, flexion being impracticable.

Dislocation backwards is caused by a severe blow upon the back of the hand, or the extremity of the finger, while it is immoderately bent. The case is recognized by the existence of a hard tumor in the natural site of the knuckle of the hand (fig. 253), and by the shortened and flexed condition of the finger, the extension of which is impracticable.

The *reduction* is generally not difficult. To effect it, extension is made upon the finger by means of a suitable lac, fastened with the sailor's noose, and counter-extension upon the hand, while firm and

Fig. 253.



steady pressure is made by the surgeon upon the head of the displaced bone.

Dr. Richard J. Levis, of this city, a few years ago devised an apparatus for reducing dislocations of the fingers and thumb, which may be used with admirable effect, as it is a powerful means, not only for securing a firm hold, but for controlling the movements of the fingers during the necessary manipulations. The adjoining cuts (figs. 254, 255), will convey a much better idea, both of the nature of the contrivance and of its mode of application and action, than any description, however elaborate. It will be perceived at a glance, that the piece of wood, which is about ten inches in length by a little over one inch in width, affords the surgeon, by its long leverage, an opportunity of extending the luxated phalanx with great power, and of rotating it at the same time upon its axis, thus facilitating its disengagement from the rounded surface of the opposing bone. When properly applied, the apparatus is perfectly unyielding, and is in every respect preferable to the clove-hitch. In its construction, it is necessary to see that the tapes are strong and broad, otherwise they will be apt to break and cause severe contusion of the integuments. Each should be about two feet long.

Fig. 254.

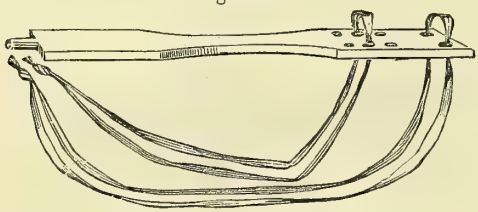


Fig. 255.



Dr. Levis's apparatus for reducing dislocations of the thumb and fingers.

The apparatus of Dr. Levis is similar to the spatha described by Celsus for reducing dislocations of the shoulder-joint, and which was so much employed by the earlier practitioners.

Excepting by the bursting of a gun, or other severe violence, dislocation of the *carpo-metacarpal* joints must be regarded as an impossible occurrence, owing to the intimate manner in which the four last bones of the metacarpus are connected with each other and with the bones of the second row of the carpus.

Under such circumstances the injury is generally so great as to render it necessary to resort to amputation, or resection, the latter operation always taking the place of the former when it is in our power to save any portion of the hand that will be likely to be of service to the patient. Conservative surgery may do much in these cases to prevent mutilation by a careful use of the knife and pliers immediately after the occurrence of the accident, when the parts are tolerant of manipulation, and admit of being put in proper form for speedy reunion. A man who cuts off a whole hand when the removal of a portion, with, perhaps, a useful finger or thumb, will answer the purpose, has no just conceptions of the duty he owes to science and humanity.

DISLOCATION OF THE CARPAL BONES.

From the firm connections and limited motions which characterize the carpal joints, it is evident that any displacement of them must be of very uncommon occurrence. Indeed, it was formerly asserted that such an accident was altogether impossible; a statement which has been contradicted by modern experience, which has not only established the fact, but elucidated the pathology and treatment of the lesion. All the carpal bones, however, are not equally liable to luxation; on the contrary, there are only three which appear to be susceptible of it—the magnum, cuneiform, and pisiform—and then only when there has been considerable relaxation of the ligaments, weakening their connections, and predisposing them to displacement under the application of comparatively slight force.

Of the three bones above mentioned, the *magnum* is the most liable to dislocation; women are supposed to be more subject to it than men, owing to the greater mobility of the carpal joints, and the weaker state of the ligaments. The accident is caused by forced flexion of the wrist, from falls upon the back of the hand, wrenching the bone from its connections with the head of the corresponding metacarpal bone, and pushing it out behind, where it forms a hard, well-defined tumor, which increases when the wrist is bent, and diminishes when it is extended. The displacement is always incomplete, and is apt to be followed by severe tumefaction, which often temporarily obscures the diagnosis.

The *reduction* is effected by firm pressure upon the bone made from behind forwards, or in a direction contrary to that of the displacement, the hand being at the time in an extended state, in order to insure greater relaxation of the soft parts, and increase the opening from which the bone has been ejected. The operation must be conducted

with great gentleness, and the surgeon must not be disappointed if he does not succeed in his first attempt. In case there is much inflammation, leeches and fomentations will probably be required. To maintain the reduction the hand must be placed in a straight position, upon two binder's board splints, well padded, and long enough to extend from the middle of the forearm to the ends of the fingers. If the tendency to displacement is very strong, as it usually is, it may be necessary to place a compress directly upon the luxated bone, with a view to a more direct concentration of the pressure. The apparatus must be worn for a long time, as the ligaments are very slow in reuniting, but care should be taken, after the first fortnight, to take it off occasionally for the purpose of moving the wrist-joint, to prevent anchylosis.

Of dislocation of the *cuneiform* bone there is hardly a well authenticated case upon record; the accident can occur only when great force is applied, and must be treated upon the same general principles as the preceding. The *pisiform* bone has been found luxated in several cases in consequence of the action of the flexor muscle of the carpus, its connections having been previously weakened by disease of its ligaments. The occurrence is attended with some annoyance, and is difficult to remedy. When the case is of sufficient importance to claim attention, the best plan is to place the hand in a slightly flexed position, in a tin case, extending from the middle of the forearm to the metacarpo-phalangeal joints, the carpal piece being so arranged as to form an obtuse angle with the other. A compress is applied to the lower and inner part of the wrist, in the situation of the displacement, and confined by adhesive strips and a bandage.

DISLOCATIONS OF THE WRIST.

The possibility of dislocation of the wrist-joint, as an independent traumatic lesion, has been alternately admitted and denied by practitioners, from an early period of the profession down to the present moment. Dupuytren, after much patient attention to the subject, and the dissection of a number of cases simulating this accident, positively asserts that he never saw an instance of it, except as a result of organic disease of the articulation. He felt persuaded that the pretended cases which had been reported by various writers were nothing but cases of fracture of the inferior extremity of the radius, an accident which, as every one now knows, is of very frequent occurrence, and is generally attended with symptoms which closely simulate those of luxation of the wrist-joint. Observations, however, made since the time of the celebrated French surgeon, both in Europe and this country, indisputably prove that, although the lesion is exceedingly uncommon, its occurrence is not only possible, but that it has been repeatedly made the subject of the most satisfactory clinical study.

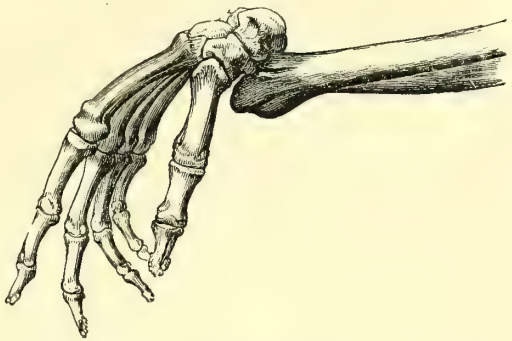
The reason of the great infrequency of this accident is altogether of an anatomical character. From the manner in which the lower extremity of the radius is joined to the scaphoid, semilunar, and cuneiform bones, it is evident that any severe force applied to the hand, as in falls, upon the palm or dorsum, must be promptly transmitted

through the carpus to the radius rather than to the ulna, which can hardly be said to enter into the composition of the joint at all, except in so far as it affords some degree of lateral support. The consequence is that the spongy and delicate structure of the radius, receiving the brunt of the injury, usually gives way, either at the articulation or in the lower sixth of its extent, instead of allowing itself to be dislocated, fracture of the brittle osseous matter being in general much easier than the laceration of a number of strong ligaments, such as are found to tie the contiguous surfaces together.

The carpal bones may be displaced from the radius and ulna backwards and forwards; lateral luxation cannot occur without fracture of one of the styloid processes, and then only in an incomplete manner.

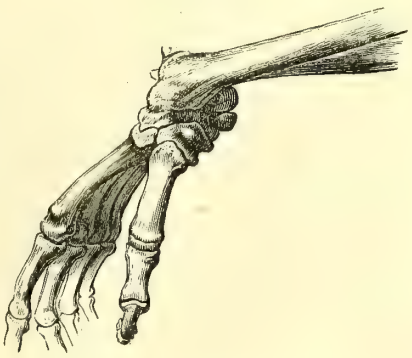
In the luxation *backwards* the carpal bones are driven up behind the ends of the two bones of the forearm (fig. 256), which lie in front of the muscles of the thenar and hypothenar eminences; the consequence is that there is great deformity of the wrist-joint, its antero-posterior diameter being much increased, although its breadth is nearly natural. The forearm is somewhat shortened, the hand and fingers are forcibly flexed, and the ulna is thrown considerably forwards and inwards beyond the line of the carpus. The radius and ulna retain their normal length, and the prominence on the back of the joint is characteristically hard, convex, and transversely elongated.

Fig. 256.



In the dislocation *forwards*, the symptoms just described are reversed, the carpal bones lying in front, and the ends of the radius and ulna behind (fig. 257). The hand and fingers are powerfully extended, the distance between the elbow and wrist is sensibly diminished, although the two bones retain their proper length, and the styloid processes can be distinctly felt behind at the lateral aspect of the hand, with the articular groove which naturally separates them, and which is now occupied by the tightly stretched extensor tendons.

Fig. 257.



These two dislocations are liable to be mistaken for fracture of the lower extremity of the radius

and ulna, although such an accident could hardly happen in the hands of a scientific surgeon, perfectly vigilant, and bent upon the discharge of his duties. The principal points of distinction are, that, in luxation, there is much more of a tumor than in fracture, that the tendons of the hand and fingers are more evidently affected, being either violently extended or flexed, that the radius and ulna retain their normal length, and that the bones are, as it were, firmly interlocked with each other. In fracture of the radius, or of the radius and ulna, on the contrary, the deformity is less marked in the antero-posterior diameter, the two bones, if both are broken, are sensibly shortened, there is much more mobility, and, upon bringing the fragments in contact with each other, and then grasping the lower part of the forearm with one hand, while the patient's hand is moved with the other, crepitation can readily be elicited. Moreover, in luxation the styloid process of the ulna generally lies upon a plane somewhat anterior to that of the radius, whereas in fracture it is behind that bone.

The *reduction* of these two dislocations is sufficiently easy. All that is required, in order to accomplish it, is to extend the hand and counter-extend the forearm, just above its middle, while pressure is applied by means of the thumbs upon the displaced carpal bones in a direction opposite to that of the luxation. The limb, enveloped in a roller, is supported upon a light splint, stretched along its palmar aspect, and kept constantly wet with some evaporating lotion. In due time passive motion is instituted, to prevent anchylosis, which is so liable to occur after all injuries of this and other joints.

Congenital dislocations are occasionally met with at the wrist, and have of late years attracted much attention, chiefly through the labors of Dupuytren, Cruveilhier, and R. W. Smith. The carpal bones may be thrown forwards or backwards, forming, in either case, a well-marked, characteristic, angular prominence. The lesion is attended with atrophy of the bones, ligaments, and muscles; the hand is generally useless, and the fingers are variously deformed, being usually wasted and crooked. Treatment is seldom of any avail.

DISLOCATIONS OF THE RADIO-ULNAR JOINTS.

1. The *inferior radio-ulnar* joint is liable to displacement in two directions, the ulna being thrown backwards in the one case, and forwards in the other, beyond the line of the radius. The slightest anatomical inspection will serve to show, what experience has proved to be true, that the former luxation must be the more frequent of the two, though both are sufficiently rare as an uncomplicated lesion. As an accompaniment of fracture of the lower extremity of the radius, it is by no means uncommon, generally, however, only in a partial manner.

The dislocation *backwards* is usually the result of violence applied to the hand or forearm, during strong pronation, any sudden twist or wrench of the joint predisposing to its occurrence. The signs are characteristic. The hand is in a fixed state of pronation, and inclined a little towards its inner margin; the head of the ulna, directed obliquely across the radius, forms a distinct prominence above the level of the

cuneiform bone; the fingers are slightly bent; the styloid process has lost its parallelism with the fifth metacarpal bone; and the inferior extremity of the forearm has an appearance of being unnaturally narrow, though, if some time have elapsed since the accident, this will probably be masked by the swelling. The reduction is effected by flexing the forearm at a right angle with the elbow, and then gradually but determinedly extending the hand, and rotating it outwards until it is brought into the supine position, when the bone will usually resume its natural relations.

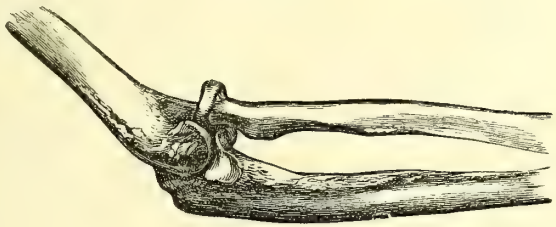
The lower extremity of the ulna may be displaced *forwards* by a fall upon the wrist, by a violent wrench of the hand while in a state of supination, or by injury applied directly to the forearm. The accident is one of uncommon occurrence. The symptoms are the reverse of those in the preceding dislocation; that is, the ulna, lying across the anterior part of the radius, forms a remarkable projection just above the carpus, while the forearm and fingers, slightly bent, are powerfully supinated, and cannot be brought out of this position without restoring the joint to its normal condition. The reduction is effected in the same manner as in the luxation backwards, the limb, as the bone yields, being gradually but forcibly pronated.

It will be necessary after both these luxations, as the ligaments will be a long time in reuniting, to keep the limb well bandaged, and supported by means of a padded splint, extending from near the elbow to the ends of the fingers. A firm compress is to be placed over the inner and fore part of the joint the more thoroughly to protect the parts against a recurrence of the accident.

2. Dislocation of the *superior radio-ulnar* joint may occur in three different directions, the head of the radius being thrown from the sigmoid cavity of the ulna forwards, backwards, and outwards, the frequency of the accident being in the order here stated, although some authorities contend that the displacement backwards is the most common. This I have not found to be the case in my own practice.

The chief causes of dislocation *forwards* (fig. 258) are falls upon the

Fig. 258.



palm of the hand, in which, the forearm being powerfully supinated, the head of the radius receives the whole force of the blow, and is thrown against the coronoid process of the ulna and the external condyle. The accident, which is most common in young subjects, may also be produced by direct injury to the upper extremity of the bone, acting from behind forwards.

The *signs* of this accident are quite characteristic. There is an obvious vacuity at the upper and outer part of the limb, and the head of the radius can be distinctly felt in its new situation, in front of the elbow, rolling about under the finger, upon rotating the lower extremity of the bone. The forearm, slightly flexed, is in a state midway between pronation and supination, and every attempt to bring it in a straight line or to a right angle with the elbow is unsuccessful. When an effort is made to bend the limb suddenly, the head of the radius will be found to strike against the lower and fore part of the humerus and refuse to advance; a circumstance which is characteristic of the nature of the accident. This dislocation is usually described as being accompanied by forced supination of the hand, but, in general, though not always, the position is as here stated.

The *reduction* is accomplished by applying extension to the hand and counter-extension to the middle of the arm, while the forearm, being semi-flexed, in order to relax the two-headed flexor muscle, is forcibly supinated, at the same time that the surgeon pushes the head of the radius downwards and backwards, in the direction of its natural position.

The most common cause of luxation *backwards* (fig. 259) is violence applied to the hand when the forearm is in a state of pronation, and carried beyond the natural line of the body. In children the accident is liable to be produced by a sudden jerk of the arm, when in an over-stretched state of pronation, by the nurse in her attempts to prevent falls, the small size of the sigmoid cavity of the ulna at this period of life, and a relaxed condition of the ligaments of the joint, favoring the result.

Fig. 259.



The peculiar attitude of the limb in this luxation is almost characteristic of the nature of the injury. The forearm is semi-flexed, and, together with the hand, in a fixed state of pronation; the fingers are also somewhat bent, and there is an evident void at the upper and outer part of the forearm, just below the elbow, while a short distance beyond this, over the external condyle, by the side of the olecranon process, the prominence formed by the head of the displaced radius is distinctly perceptible, feeling hard and firm, and but faintly responding to any motions that may be impressed upon the lower extremity of the bone. Any attempt, short of what is requisite to effect the reduction, to supinate the limb, to bring it in a straight line, or to flex it at a right angle with the arm, is quite abortive, owing to the manner in which the radius hitches against the humerus.

Reduction is effected by making extension upon the hand and counter-extension upon the lower part of the arm in the line of the displacement, while the surgeon presses the head of the radius from behind forwards, towards the lesser tubercle of the humerus, at the same time

that the hand and forearm are gradually but forcibly supinated. When the patient has not been relaxed by chloroform, the return of the bone is always indicated by a distinct snap.

Dislocation of the radius *outwards* is not as common an accident as either of the preceding varieties of displacement. It occasionally exists, in an incomplete form, as a result chiefly of a relaxed condition of the annular ligament, in persons of a feeble and relaxed habit of body. Complete luxation outwards can happen only when there is a rupture of the upper extremity of the interosseous ligament, and hence the lesion is apt to be complicated with fracture of the humerus, or ulna, and severe injury of the soft parts. A fall upon the palm of the hand, propelling the radius upwards and outwards, with the whole force of the leverage of this bone, is the most common cause of the accident.

The *symptoms* are the following. The head of the radius, resting upon the epicondyle of the humerus, forms a distinct prominence at the outer part of the elbow, easily recognized by the finger; the bone is situated higher up than natural, the distance between it and the olecranon being materially increased; the forearm is in a state midway between pronation and supination, the latter of which is impossible; and the movements of flexion and extension are of course much impeded. Besides these signs, there is always a cord-like prominence along the front of the radius, as well as on the inside of the displaced head, formed by the tension of the external radial and long supinator muscles, which is gradually lost upon the outer and anterior surface of the limb. The reduction is effected by pushing the radius downwards and forwards, the forearm being bent at a right angle, and extension and counter-extension made in the usual manner.

The reduction of all these dislocations is generally sufficiently easy, but they are extremely apt to recur from the slightest causes, and it, therefore, becomes an object of great consequence, in the after-treatment, to guard against the accident by the use of the compress and bandage, aided by a suitable apparatus, to insure perfect quietude, until the ligamentous structures have had an opportunity of reuniting. Meanwhile, passive motion must be attended to, lest anchylosis ensue.

The superior radio-ulnar joint is liable to a species of *subluxation*, similar to what occurs in the temporo-maxillary articulation. I have seen several well-marked cases of it, in one of which it existed simultaneously on both sides; and in all it was manifestly dependent upon a relaxed condition of the annular ligament, allowing the head of the radius to move away to some distance from the sigmoid cavity of the ulna. The subjects of this displacement are, for the most part, thin, weakly children of a strumous habit of body, and my experience teaches me that females are more frequently affected than males. The movements of the joint are not materially impaired by the occurrence, unless it persists and gets worse, when the whole limb may become enfeebled in consequence. The cold douche, painting with tincture of iodine, and the application of a series of small blisters, with tonics to improve the general health, are the best remedies.

DISLOCATIONS OF THE ELBOW.

The dislocations of the elbow-joint form a subject of the deepest possible interest to the surgeon, not only on account of the frequency of their occurrence, but because of their great liability to serious complications and the consequent difficulty of their diagnosis and treatment. I am satisfied, from no little observation, that there are no luxations in the whole body which are so little understood, or so unscientifically managed, as those now under consideration. The principal reason of this is the want of correct knowledge of the structure of the elbow-joint, and of the complex arrangement of its osseous elements, with which few practitioners take the trouble to make themselves acquainted. The result is that cases of dislocation constantly occur, which are mistaken for fracture, and which, in consequence, are entirely neglected until it is too late to remedy them by means which, if timeously employed, would nearly always be sufficient to insure the reduction of the displaced bones, and the restoration of the bruised and lacerated structures, with complete recovery of the functions of the articulation. I make these remarks because it has been my lot to see an unusually large number of badly-treated cases of dislocations of the elbow-joint, in almost every stage after their occurrence, from the first few hours to several months, when, in general, all hopes of benefiting the patient must be abandoned.

The most common dislocation of the elbow is that in which both bones of the forearm are thrown upwards and backwards, in contact with the posterior surface of the humerus. Displacement forwards is exceedingly uncommon, and can only take place, as a general rule, when the accident is complicated with fracture of the olecranon process, whereby the ulna is permitted to glide in front of the joint, which it must have great difficulty in doing when its superior extremity remains intact. Lateral luxation of both bones of the forearm from the condyles of the humerus is also very infrequent, and is necessarily incomplete, owing to the great extent of the articular surfaces in this direction, and the number, size, and strength of the muscles and ligaments surrounding the joint. Of the displacements of the superior radio-ulnar articulation, I have already given an account, and need, therefore, not repeat here anything that was then said. The ulna alone is sometimes luxated upwards, the olecranon forsaking the sigmoid fossa of the humerus, and placing itself in contact with the posterior surface of the bone.

1. Dislocation of the bones of the forearm *backwards*, or, more correctly speaking, backwards and upwards, usually occurs from falls in which the person, instinctively stretching out the arm to protect the body, receives the whole shock upon the palm of the hand. The two bones being thus impelled by the surface struck by the hand, and the humerus by the weight of the body coming in the opposite direction, the two forces explode at the elbow-joint, rupturing the ligaments, and driving the olecranon and head of the radius backwards and upwards. There can be no doubt that a contorted state of the forearm at the

moment of the accident greatly promotes the luxation by increasing the strain.

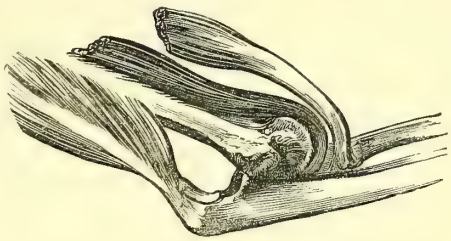
The *signs* of this dislocation are sufficiently obvious, presenting little variation in their character, unless it is conjoined with other injury. The limb is in a semi-flexed state, and there is great deformity of the elbow. At the posterior part of the joint is the unnatural projection formed by the olecranon, and, in front, the still more conspicuous one formed by the condyles of the humerus (figs. 260 and 261), both usually perceptible by sight and touch, especially in lean subjects, and before the supervention of swelling. The forearm has generally a slightly twisted appearance, and occupies a position midway between pronation and supination, inclining, however, more to the latter than the former; any attempt to flex or extend it is not only very painful, but in great measure impracticable. The fingers are somewhat bent, and the distance between the elbow and wrist is sensibly diminished, generally from an inch to an inch and a half, but only in front, for behind the limb retains its normal length. The muscles in front of the joint, especially the flexor and brachial, are stretched like tense cords over the condyles of the humerus, while the tendon of the three-headed extensor is carried away from the bone behind, and stands out in bold relief, forming one of the most conspicuous signs of the accident. Although generally the forearm is semi-flexed, and nearly immovable, yet occasionally it is almost straight, and can be readily bent and extended, though not without great pain.

Fig. 260.



Dislocation of both bones backwards.

Fig. 261.



Notwithstanding that the signs of this dislocation are usually characteristic, cases, nevertheless, occasionally occur where the *diagnosis* is painfully obscured. Two circumstances principally contribute to render it so. One is the inordinate swelling which so generally follows the accident, and which often exists in a high degree before the surgeon has an opportunity of examining the parts; and the other, the existence of fracture of the bones composing the joint. When the humerus is broken off just above the condyles, the deformity will closely simulate that produced by dislocation backwards, the lower fragment, with the radius and ulna, being drawn in that direction, so

as to give the back of the elbow a very prominent and distorted appearance, while the upper fragment will present itself quite conspicuously in front, under the flexor muscles. The points of distinction are that, in dislocation, the parts are fixed, and cannot be restored without a good deal of effort, whereas, in fracture, they are easily moved and restored to their proper position, returning, however, to their unnatural situation the moment the efforts are discontinued. In dislocation, moreover, there is actual shortening of the anterior part of the forearm, but none in fracture; nor is there, in the former, any crepitation, which is always so conspicuous a sign in the latter. Fracture of the olecranon can always be distinguished by the elevation of the upper fragment, and the wide gap which separates it from the lower, and by the facility with which the surgeon can flex and extend the forearm. In fracture of the head of the radius, there is no deformity of the posterior part of the elbow, and by grasping the bone with the thumb and finger above, as it is being rotated below, crepitation can be easily elicited, thus at once clearing up the diagnosis.

The *reduction* of this dislocation is extremely easy, if attended to immediately after its occurrence, but very difficult if it be neglected even for a short time. Upon this subject, there is no difference of sentiment among practitioners, writers, and teachers. My experience in regard to it is ample, and in perfect accordance with that of the profession generally. I have no recollection of ever being foiled in my efforts in a solitary instance of recent dislocation of the elbow-joint, while I can recall to mind a large number of cases where everything that could be done proved unavailing after the third week, and sometimes even by the end of the second. I am not prepared to assign any reason for this; to say why a displacement, that is always so easily rectified, if properly managed, in its earlier stages, should so soon become utterly irreducible, resisting and defying all the best directed efforts of the surgeon. We can hardly suppose that it is owing exclusively to inflammatory adhesions, for it is difficult to conceive that they could become either so extensive or so firm, in so short a time, as to produce such a result; whatever, however, the true explanation may be, the fact remains, and this is all that is really necessary for us to know. The practical rule, then, to be deduced from this experience is that all dislocations of the elbow backwards should receive the earliest possible attention, their reducibility being in an inverse ratio to their duration.

The reduction of this dislocation may be effected by various methods. The one which I have usually found most efficient, and which, I believe, has not been practised by any one else, is to place the heel in the bend of the arm, the patient lying down, and the surgeon carrying his leg across the chest, while extension is made by pulling the hand and wrist. This procedure affords the operator an opportunity of exerting his strength to great advantage, and I have not seen a case of recent dislocation that could resist his efforts beyond a few minutes. As the bones yield the forearm is bent towards the chest over the fulcrum, furnished by the foot, a step which materially promotes the reduction. The force of the extension may be greatly increased by

securing a stout lac round the limb, just above the wrist, and throwing the noose over the neck and shoulder. Counter-pressure may also be advantageously made by an assistant placing his hands against the shoulder of the affected side. The patient should, of course, be under the influence of chloroform.

Another method, which is also very advantageous, is to make a fulcrum of the knee in the bend of the arm, the patient being seated upon a chair, and the surgeon standing by his side in front with his foot resting upon a high stool, or upon another chair. The extension being conducted as in the previous case, the forearm is gradually brought over the knee so as to disengage more effectually the ulna and radius from the lower extremity of the humerus. This manœuvre is usually very promptly successful.

A third method of reduction, based upon the same principles as the preceding, is to bend the limb forcibly round a bedpost, which is thus made to act as a fulcrum, while the requisite extension is made by pulling the hand and wrist. This plan, however, although efficient enough, has the disadvantage of being both awkward and painful.

Finally, the reduction may often be readily effected by seating the patient upon a chair, and requesting two assistants to make extension and counter-extension, one grasping the wrist, the other the middle of the arm. The surgeon, standing behind the affected limb, then places his thumbs firmly upon the olecranon, and thus aids in pushing this process downwards and forwards into its natural position.

When any great difficulty is expected, as when the patient is very muscular, or the joint has been luxated for some days, or several weeks, the best method, after the ordinary procedures have failed, is, to use the pulleys hooked to the noose round the lower extremity of the forearm, and to a staple in the wall, floor, or bed. The counter-extending band is secured round the middle of the arm, and is either confided to two stout assistants, or fastened to some firm object behind the patient's head and shoulder. The patient should, of course, be recumbent, and fully anæsthetized. After the extending forces have been maintained for some time, the return of the bones will be promoted by steady pressure upon the olecranon. When these means fail, as they will be extremely apt to do, if the case is of longer standing than three weeks, it has been proposed to insert a narrow bistoury into the joint, so as to divide the resisting structures, but the operation, besides being dangerous, on account of the proximity of the brachial artery and the several nerves of the limb, has not realized the expectations that had been formed of it by its advocates.

Reduction being effected, the limb, carefully bandaged, must be supported in a light tin case, and kept constantly wet with evaporating lotions. If the inflammation run high, as it generally does after such an injury, leeches and even venesection may become necessary. In every case, however simple, the greatest vigilance must be employed to prevent anchylosis. Passive motion must, of course, receive early attention.

2. Dislocation of the bones of the forearm *forwards* is an extremely rare event, which was formerly supposed to be altogether impossible

without previous fracture of the olecranon, or extensive laceration of the soft parts. Modern observation, however, has shown the fallacy of this opinion, by adducing several unequivocal cases in which the displacement existed as a pure, uncomplicated affection. The manner in which the occurrence may happen is not well understood; but from some experiments performed upon the dead subject it would seem that if, while the forearm is powerfully flexed upon the arm, severe violence be applied directly to the olecranon and head of the radius, the articular surfaces of these bones may be thrown forwards from the condyles of the humerus with much greater facility than would at first sight appear possible. But, whatever explanation may be offered, the fact is that the accident must necessarily be attended with extensive rupture of the ligaments, and generally also with pretty severe contusion of the soft parts. A majority of the published cases of this accident have been observed in subjects under fifteen years of age, in consequence of falls upon the posterior part of the elbow.

The *signs* of the dislocation are sufficiently characteristic. When the ulna and radius are thrown completely forwards, in front of the condyles of the humerus, the forearm will necessarily be considerably shortened, whereas, when they retain their relation with the condyles, it will be elongated to the full extent of the length of the olecranon. The forearm, moreover, is slightly flexed, but by a little effort it may readily be extended, or even bent somewhat backwards. The integuments and muscles in front of the joint are in a state of tension, the end of the humerus can easily be felt posteriorly, where it forms a large prominence, and there is a well marked depression, a kind of vertical gutter, in the natural situation of the olecranon, bounded on each side by the margins of the trochlea.

Two methods of *reduction* may be employed for this dislocation; one consists in flexing the forearm at a right angle with the elbow, and making extension by pulling the hand and wrist, while the heel is applied as a fulcrum to the lower third of the arm, the patient being under the influence of chloroform. Or, instead of this, the extending and counter-extending forces may be applied to the hand and shoulder, the limb being in the straight position, and pressure made upon the ulna and radius by means of the thumbs. During the after-treatment, leeches and fomentations will probably be required, and the limb must be supported in splints or a tin case until the parts have reunited. Passive motion must be commenced at an early period.

3. *Lateral* dislocation of the elbow joint, besides being extremely rare, can scarcely occur in any other than an incomplete form, and as a consequence of severe injury extensively implicating the soft parts. The most common cause of the accident is a fall upon the wrist or hand when the forearm is in a flexed and contorted state; and the displacement will be so much the more likely to happen if, the moment the extremity strikes the surface, the arm is forcibly impelled sidewardly. It may also be produced by violence acting directly upon the forearm and arm in opposite directions, as when the former is driven inwards and the latter outwards. In a case mentioned by J. L. Petit the accident was occasioned by the limb becoming entangled in the spokes of

a wheel. The displacement may be inwards or outwards, and is often associated with partial dislocation backwards.

In the dislocation *inwards* (fig. 262) there is great deformity at the ulnar side of the elbow, formed by the olecranon and head of the radius, the latter hitching against the inner condyle, while the outer condyle presents an unusual prominence immediately beneath the integuments at the external aspect of the joint; the forearm is partially bent, and somewhat supinated; and the muscles of the arm, both in front and behind, are dragged inwards by the displaced bones.

Fig. 262.

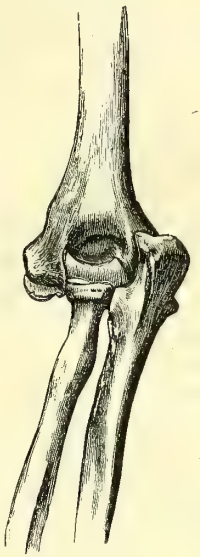
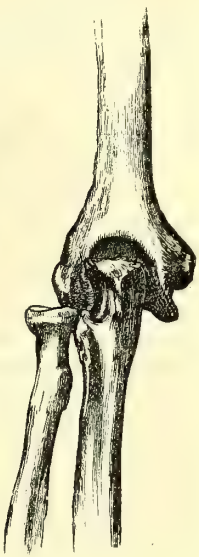


Fig. 263.



In the luxation *outwards* (fig. 263) the ulna rests upon the external condyle, while the inner condyle forms a sharp prominence on the inside of the elbow; the forearm is slightly bent and rigidly pronated; the motions of flexion and extension are much impeded; and the flexor and extensor muscles are in a painful state of tension. Both in this and in the inward displacement there is a remarkable increase in the breadth of the articulation, along with considerable flattening of its anterior surface, and a twisted condition of the forearm.

These luxations are easily reduced by extension and counter-extension, performed in the usual manner, and by coaptation by pressing the bones in a direction opposite to that of their displacement. In general, the object may easily be attained by simply bending the elbow over the knee, as in the dislocation backwards. The after-treatment requires great care, both to prevent re-displacement and anchylosis.

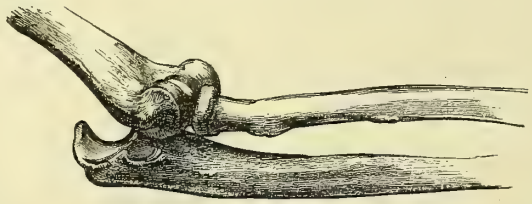
The only instance of complete lateral dislocation of the elbow with which I am acquainted is one which occurred in the practice of Nélaton, and of which he has given an account, accompanied with a drawing, in his treatise on surgery. It was observed in a man, aged sixty, who was admitted for another disease, the accident having taken place twenty years previously, in consequence of a fall from a height of thirty feet. The elbow was much deformed and anchylosed.

The elbow is sometimes dislocated as a *congenital* defect; the accident presenting itself, however, only in a partial form. Most generally the displacement is limited to the head of the radius, which, forsaking the sigmoid cavity of the ulna, applies itself against the outer condyle. The movements of the elbow and forearm are restricted, but not annihilated; and, as the head of the luxated bone always becomes remark-

ably elongated as the patient advances in years, reduction is only practicable in infancy and early childhood.

4. Dislocation of the *ulna* alone directly backwards is an uncommon accident, and can scarcely be complete without fracture of the coronoid process. The signs are usually characteristic. The forearm and hand are slightly flexed, and inclined inwards as if they were twisted on their axis; the olecranon forms a prominent projection at the back part of the joint (fig. 264); and the head of the radius, though usually

Fig. 264.



somewhat displaced, may be distinctly felt in its natural situation during the movements of flexion and extension, both of which, but particularly the latter, are very much restricted and painful. The accident generally arises from severe falls upon the inner and upper part of the hand, suddenly and forcibly impelling the ulna upwards and backwards, away from the head of the radius; the coronoid process lodging in the sigmoid cavity of the humerus. Its most prominent features are the contorted state of the limb and the remarkable projection of the olecranon, which will always serve to distinguish it from other lesions. When the coronoid process is broken off, the posterior deformity will be unusually great, and, although it may be effaced by extension, yet the moment the arm is left to itself it returns.

The *reduction* may generally be easily effected by bending the arm over the knee, and extending the hand and wrist. Coaptation may be aided, if necessary, by pressure upon the olecranon with the thumbs. When the accident is attended with fracture of the coronoid process, special retentive means will be necessary, of which the best is a rectangular tin-case, the limb being properly bandaged, and a compress firmly bound over the olecranon.

Finally, the bones of the forearm are occasionally dislocated simultaneously in *opposite directions*, the ulna being thrown backwards behind the humerus, and the radius forwards upon a plane with the external condyle. The occurrence is uncommon, not more than five or six cases having yet been reported, and of these none have occurred in my own practice. It is produced by falls from a considerable height upon the hand, impelling the two bones with great violence at a moment when the forearm is considerably flexed and forcibly twisted upon its axis. It is readily recognized by the singular form of the elbow, which is sensibly shortened transversely, but much increased in its antero-posterior diameter; by the great prominence at the back of the limb, formed by the olecranon process; and by the remarkable inward contortion of the forearm and hand, which are both slightly

bent. On attempting to flex the limb, the head of the radius is found to hitch against the humerus, and to offer an insurmountable barrier to further progress. The reduction of the ulna is readily effected by placing the knee in the bend of the arm, and then pulling the hand and wrist; but that of the radius is more difficult, and will require, in addition, pressure upon the dislocated head outwards and backwards.

Compound dislocations of the elbow constitute a serious class of lesions, liable to be followed by the worst results, both immediate and consecutive. Such is the extent of the articulating surfaces that any considerable exposure by wound is extremely apt to cause ulceration of the cartilages and caries or necrosis of the bones, requiring their eventual removal, or, what is worse, the sacrifice of the limb. The danger is materially increased when there is fracture with displacement, the end of one of the bones perhaps protruding in the form of a sharp spiculum at the wound. Such cases will seldom progress favorably if an attempt be made to replace and save the parts in the usual manner. It is true, the patient, if young and vigorous, may occasionally weather the storm, but the chances, I am sure, are that the limb will, by and by, have to come off, or that life will be placed in imminent danger by the protracted suppuration, ulceration, and hectic irritation. When, therefore, the symptoms are at all unpromising—the joint being extensively opened, the muscles torn, and the bones seriously involved—the best plan, as a general rule, will be to amputate on the spot, that is, the moment reaction has occurred; or, under more favorable, but still trying circumstances, to excise the ends of the injured bones, placing them in such a position as to insure their speedy reunion, and, at the same time, in as good a one as possible for the future usefulness of the limb.

DISLOCATIONS OF THE SHOULDER.

Dislocations of the shoulder-joint are of common occurrence, and, therefore, deserving of great attention. As has been stated elsewhere, they are more frequent than all the other dislocations together, a circumstance which is easily accounted for by the shallow condition of the glenoid cavity of the scapula, and the extraordinary latitude of motion peculiar to this articulation. Moreover, there is in many persons, females and children especially, a remarkable tendency to relaxation of the ligaments and muscles of the shoulder-joint, which thus powerfully predisposes to luxation, the slightest accident being, under such circumstances, often sufficient to produce it.

Experience has shown that dislocations of the shoulder are not near so common in women as in men; simply, however, I imagine, for the reason that they are much less exposed than the other sex to the various exciting causes of these lesions. If there is any anatomical reason for the difference, it has not been pointed out.

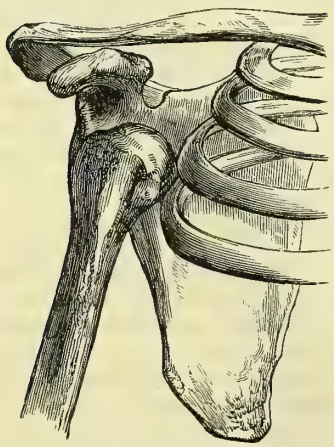
Age exerts a material influence upon the production of these luxations. The statistics of Malgaigne and others have proved that children under fifteen years rarely suffer from them. My own practice has not afforded me a solitary example under the age of twelve. From

fifteen to twenty-five, the accident is also comparatively rare, but from this period on it becomes more common, and from forty to sixty it reaches its maximum. After sixty, there is a marked decline in its frequency, and after seventy few cases are met with.

The *nomenclature* of dislocations of the shoulder has been much encumbered by the modern French surgeons with distinctions and refinements, which, so far from simplifying the subject, only serve, in my judgment, to embarrass it. It certainly does not facilitate the inquiries of the pupil to be told that there are ten or a dozen distinct forms of luxation, when all that is really useful and important may be comprised under less than half that number of divisions. Such minutiæ never fail to retard the true interests of science, and disgust the student of surgery. There are, in truth, but three principal dislocations of the shoulder; all the rest, concerning which so much has of late been said and written, being mere varieties, hardly entitled to separate consideration. These dislocations are the axillary, thoracic, and scapular. In the first, as the name implies, the head of the humerus is situated in the axilla, under the glenoid cavity; in the second, below the clavicle, on the anterior and lateral aspect of the chest; and in the third, on the scapula, beneath the spine of that bone. To these may be added, as varieties of the first two luxations, those cases in which the head of the bone has been found in the sub-scapular fossa, and upon the anterior part of the neck of the scapula, below the coracoid process. The nomenclature here suggested, besides indicating the situation of the luxated bone, is in strict conformity with that of the dislocations of the hip-joint.

1. The *axillary dislocation*, by far the most frequent of all, is usually occasioned by violence applied to the elbow or hand, the limb being elevated, and widely removed from the body. It may also be produced, when the arm is in this position, by a fall or blow upon the shoulder, acting directly upon the head of the humerus. I have seen three cases in which the accident was caused by the contraction of the muscles, and several examples of a similar kind have been communicated to me by professional friends. In two of the cases here referred to, the luxation happened in an attack of epilepsy, and in the other in consequence simply of inadvertently raising the arm above the level of the head. However induced, the head of the humerus will be found to be in the axilla, just beneath the glenoid cavity, lying upon the inferior border of the scapula (fig. 265), between the sub-scapular muscle and the long head of the triceps. The axillary vessels and nerves are somewhat compressed, the capsular

Fig. 265.



ligament is largely opened below, and the articular muscles are nearly always more or less lacerated, if not partially separated from their attachments.

The *symptoms* are, inordinate prominence of the acromion (fig. 266), which is much more sharp and distinct than naturally, with a well-marked depression just below this process; flattening of the shoulder, and unusual fulness of the axilla, caused by the presence of the displaced bone, which, on motion of the limb, can easily be felt rolling about between the thumb and fingers, especially in lean subjects. The elbow projects considerably from the side, in consequence of the tension of the deltoid muscle, the forearm is slightly bent, the arm is perceptibly lengthened, the fingers are numbed, from compression of the axillary nerves, and the whole extremity, stiff and powerless, is generally somewhat supinated, although not necessarily so, for I have repeatedly seen it inclined in the opposite direction. Flexion of the forearm, also, is not an invariable occurrence; generally it is said to be so, but several cases have come under my observation where the patient was able to extend and bend it at pleasure. When the biceps and triceps are put considerably upon the stretch, as happens when the head of the bone is thrown unusually far inwards, the limb often presents a singularly twisted appearance.

Fig. 266.

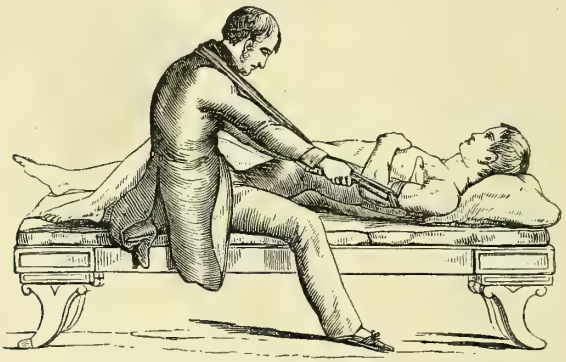


It seems hardly credible that an accident which is always so well marked as dislocation of the head of the humerus downwards into the axilla should ever be overlooked, or mistaken for any other lesion, and yet such is the fact, as daily experience abundantly attests. The most reliable *diagnostic signs* are the flattening of the deltoid muscle, the projection of the acromion process, the fulness of the axilla, and the separation of the elbow from the side of the body and the inability of the surgeon to approximate it to its surface without compelling the patient to depress the corresponding shoulder. The latter symptom I regard as especially valuable, for I know no other lesion that simulates it. Another diagnostic sign, also, of great certainty, has recently been

pointed out by Professor Dugas, of Augusta, Georgia. In consists in the fact that in dislocation of the scapulo-humeral articulation, in whatever form occurring, neither the patient nor the surgeon can place the fingers of the injured limb upon the sound shoulder, while the elbow touches the front of the chest.

Various methods may be employed for effecting the *reduction*, but the one which I usually prefer is to place a fulcrum in the axilla,

Fig. 267.



upon the head of the luxated bone, while extension is made upon the forearm, just above the wrist. The best fulcrum for this purpose is the heel of the surgeon, divested of its boot, he and the patient lying in opposite directions upon a bed or table; and the efficiency of the operation will be materially increased if, after the extension has been maintained for a little while, the limb be gradually brought forwards over the body, so as to raise the bone upwards and outwards to a level with the glenoid cavity. I sometimes find that I can reduce the dislocation more promptly and with less effort by sitting between the patient's limbs, with my own leg carried obliquely over the trunk, as this affords a much more powerful leverage than in the ordinary procedure. When unusual resistance is encountered, the extension should be aided by means of a stout fillet, secured round the forearm by the clove-hitch, and thrown across the surgeon's neck and shoulder. Finally, care should be taken not to raise the patient's head with a large pillow, nor yet to let it lie entirely flat, as both these positions would have a tendency to impede the reduction. Slight elevation only is desirable.

Occasionally the reduction is readily accomplished by making a fulcrum of the knee (fig. 268), the patient sitting up, and the surgeon supporting his foot upon the edge of his chair, or upon another chair standing close by. The operation is particularly applicable to dislocations occurring in delicate females, and in old emaciated subjects. It is performed by inserting the knee as high as possible in the axilla, and then, the top of the shoulder being thoroughly steadied with the hand, carrying the elbow forcibly downwards and inwards towards the

side of the body. This procedure is characterized by great simplicity, but wants the efficiency of the preceding.

Another method which may advantageously be employed is that devised by White, of Manchester, in the last century, and recently revived by Malgaigne. The patient lying upon his back, the surgeon stands or sits behind him (fig. 269), and raising the limb perpendicularly along the side of the head, he firmly fixes the shoulder, with one hand upon the acromion, while with the other he makes the requisite extension by pulling the lower part of the arm. In this way the luxated head of the bone is drawn directly upwards into the glenoid cavity.

Fig. 268.

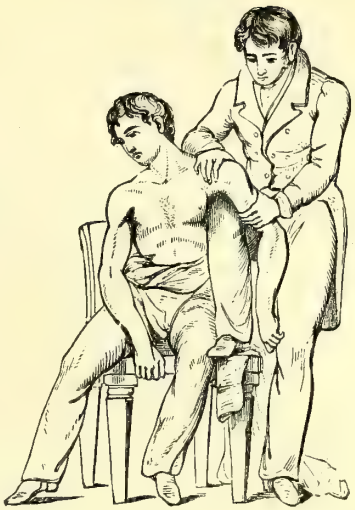
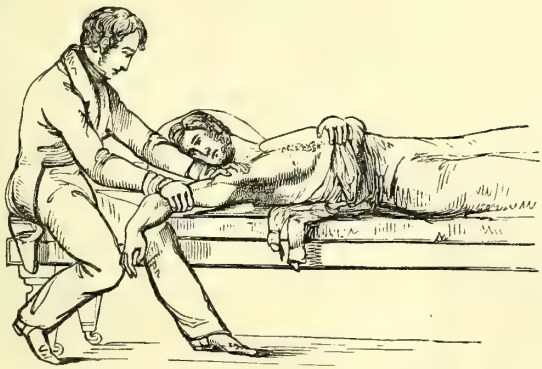


Fig. 269.



Mr. Kirby, of Dublin, was in the habit of reducing this luxation by a method somewhat more complicated than any of the preceding, but not less efficient. The patient being seated upon the floor, a stout fillet was secured round the lower part of the arm, and confided to an assistant, while another assistant, also seated upon the floor upon the opposite side, steadied the scapula by encircling the chest with his arms, his fingers being interlocked in the axilla. When the preliminaries were arranged, the assistants carried each one leg behind and the other in front of the patient, so as to rest the soles against each other. The limb being now elevated nearly to a right angle with the body, the extension was made in a slow and gradual manner, while the head of the bone was urged upwards towards the glenoid cavity, the elbow being at the same time raised and brought towards the side.

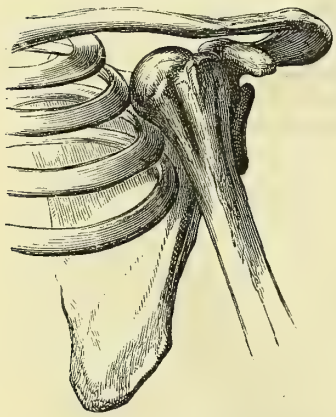
Finally, reduction may occasionally be accomplished by simple torsion of the limb, especially by rotation from without inwards, as re-

commended by Mons. Lacour. The operation is performed by grasping the lower part of the forearm, and then turning the limb upon its axis, which has the effect of throwing the head of the humerus backwards and outwards, towards the glenoid cavity, when all that is necessary to induce it to slip into its proper position is to bring the limb on a line with the trunk.

I have never had occasion to employ the pulleys in recent dislocations of the shoulder, and can hardly imagine that they could be necessary even in very stout, muscular subjects, as any surgeon may with a little patience and skill effect reduction by the methods now pointed out with the aid of chloroform. Should a resort to the pulleys, however, be demanded, they must be employed with great care, lest harm should befall the axillary vessels; for the very fact that restoration cannot be accomplished by manual effort is an evidence of probable complication, and should be sufficient at least to put the surgeon on the alert. The operation is performed during the recumbency of the patient. The shoulder is firmly fixed by means of a long fold of muslin, the hand being passed through a hole in the centre, and its ends held by assistants, or fastened to a staple in the wall. The extending band is tied round the lower part of the forearm, just above the wrist, and secured to the pulleys, which are then put in motion, the forces being applied transversely, and the head of the bone, as it approaches its socket, being lifted up by the hands in the axilla.

2. The *thoracic* variety of dislocation, the subclavicular of the French surgeons, is comparatively rare, and is usually caused by violence applied directly to the head of the humerus, or to the elbow, when the arm is elevated, and carried behind the central line of the body. The bone is thrust to the sternal side of the coracoid process, just below the clavicle, resting against the second and third ribs, under cover of the pectoral muscles (fig. 270). The anterior and inner part of the capsular ligament is extensively ruptured, and there is usually considerable injury sustained by the adjoining muscles, especially the subscapular, the infra-spinate, and the small teres, which are often severed from their attachments to the head of the bone.

Fig. 270.



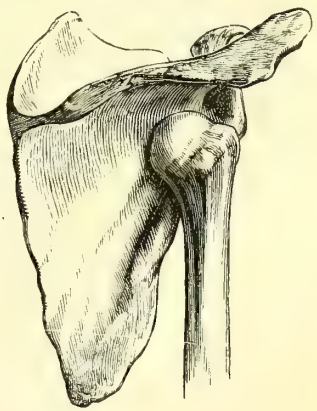
The *signs* of this dislocation are usually well marked. The acromion juts out with great distinctness, the depression beneath it being much more conspicuous than in the axillary variety of the accident, in consequence of the manner in which the deltoid muscle is drawn over towards the chest; and the head of the humerus can generally be easily perceived just below the clavicle, forming a hard prominence which readily obeys the movements of the limb. The elbow stands off widely from the body, in a backward direction, and the arm is

commonly shortened from half an inch to an inch. The pain is less severe than in dislocation into the axilla, as there is no compression of the axillary plexus, but the impairment of the functions of the joint is greater. The most important diagnostic marks are the peculiar attitude of the limb, the extraordinary prominence of the acromion, and the position of the head of the bone just below the middle of the clavicle, where it can generally be both felt and seen.

The *reduction* is easily accomplished by placing the heel in the axilla, so as to fix the scapula, and making the extension obliquely downwards and a little backwards, in the line of the displacement. The patient should lie upon the sound side, and as the head of the bone approaches the glenoid cavity it should be urged on by the pressure of the foot, at the same time that the arm is brought over to the body, very much as in the dislocation downwards.

3. The *scapular* form of dislocation of the shoulder is an uncommon occurrence, and it is only within the last thirty years that its claim to a distinct variety has been fully established. One of the earliest cases of the kind with which I am acquainted happened in the practice of Dr. Physick, in 1811. A goodly number have since been reported by different surgeons; still the accident is undoubtedly a rare one. It is generally produced by a fall upon the elbow or hand, the limb being at the moment raised, and stretched out in advance of the body, a movement which has the effect of slightly depressing the head of the humerus, and of throwing it backwards upon the posterior surface of the scapula, below the spine of that bone (fig. 271), and between the infra-spinate and small teres muscles. The inferior part of the capsular ligament is extensively opened, and the articular muscles are also generally seriously implicated in the mischief, their fibres being not only stretched, but often severely lacerated. It has been asserted that this luxation is always incomplete; but after a careful examination of some of the reported cases, I am satisfied that this opinion is incorrect.

Fig. 271.



The *symptoms* which characterize this luxation are sufficiently prominent. The rotundity of the shoulder is diminished, but not completely destroyed, the acromion is abnormally distinct, and the head of the humerus can be both seen and felt in its new position, lying at the root of the spine of the scapula, at the posterior part of the shoulder. The arm is considerably shorter than in the natural state, and the forearm, strongly rotated inwards, is bent obliquely across the chest. The axilla is deprived of its fulness, and upon making firm pressure there, before there is any considerable swelling, the finger can be made to sink into the glenoid cavity. Supination of the limb is wholly impossible, and indeed all attempts at motion are productive of an unusual degree of pain and

distress, owing to the manner in which the head of the humerus is impacted under the outer border of the acromio-coracoid arch.

The *reduction* is effected by making extension and counter-extension in the usual way, and urging the head of the bone from behind forwards by means of the hand, until it can be perceived in the axilla, when the restoration is to be completed by bringing the arm gently downwards and backwards into a line with the body and a little in advance of it.

General Diagnosis.—Although the diagnosis of dislocations of the shoulder-joint is usually sufficiently clear, yet cases occasionally occur where it is quite the reverse. There are several accidents with which they are liable to be confounded, from all of which it is of great importance that they should be correctly distinguished. Thus, mere contusion of the deltoid muscle, or a sprain of the articulation, sometimes simulates to a very perplexing extent the symptoms of luxation, by causing more or less obliquity of position of the arm, with inability to raise it; and the inexperienced practitioner is consequently liable to treat the case with improper severity, employing, perhaps, violent extension and counter-extension, when nothing but the most simple treatment is necessary. In general, however, the diagnosis is easily enough determined by a careful inspection of the affected joint. If there be no displacement, the head of the bone will be found to occupy its natural position, the shoulder to preserve its rotundity, and the arm to retain its natural length. Motion, too, will be found to be perfect if the patient be examined while under the influence of chloroform.

Great perplexity will be likely to arise when there is a fracture of the acromion, the neck of the scapula, or of the superior extremity of the humerus; hence, whenever such an occurrence is suspected, the surgeon cannot possibly be too much upon the alert. In each of these accidents there are three circumstances, which, if carefully considered, will always serve to prevent mistake. These are preternatural mobility of the parts, crepitation, and facility of reduction, followed by an immediate recurrence of all the symptoms the moment the surgeon relinquishes his hold upon the limb. In dislocation, the head of the humerus is firmly fixed in its new situation, and is consequently moved with difficulty; there is complete absence of crepitation, or, if there be any noise and sensation of this kind, they are all very faint, being entirely different from those which are caused by rubbing together the ends of a broken bone; and, lastly, the restoration of the displaced bone can be effected only after much effort, generally not without energetic extension and counter-extension. Moreover, the reduction being once effected, the articular surfaces usually retain their natural relations, having no disposition again to separate.

In fracture of the acromion, the outer extremity of the bone is drawn down by the action of the deltoid muscle, giving the shoulder a sunken appearance, and the arm is sensibly elongated and supported by the patient's hand. Restoration is readily effected by lifting up the elbow, but upon abandoning our hold, there is an immediate reproduction

of all the former symptoms, thus at once deciding the nature of the injury.

In fracture of the neck of the scapula, a very rare accident, the acromion retains its natural position, but is uncommonly prominent; the arm is elongated, and crepitation is easily elicited by raising the elbow, which will also have the effect of restoring the form of the joint.

The signs of fracture of the head and neck of the humerus are generally characteristic. The extremity of the bone, constituting the upper fragment, remains in the natural position, while the rough, angular end of the shaft projects upwards and inwards into the axilla, being drawn hither by the pectoral and dorsal muscles. There is no displacement of the acromion, the shoulder is less flattened than in luxation, and the arm, instead of being elongated or of the natural length, is materially shortened.

Complicated Dislocations.—Dislocation of the shoulder is sometimes, as just seen, complicated with fracture of the acromion, the neck of the scapula, or the superior extremity of the humerus. Whenever such a coincidence obtains, the rule is always to reduce the dislocation before we set the fracture, though the efforts at restoring the joint will generally be greatly promoted by putting up the limb temporarily in splints, as it will thus afford the surgeon a better leverage, which may be used with much effect in returning the luxated bone to its proper place.

Compound dislocations of the shoulder-joint are rare in civil practice. When the head of the humerus is forced through the soft parts, no time should be lost in restoring it to its natural position, provided it has not sustained any serious detriment, in which case I am satisfied that it ought to be exsected, so as to afford the patient a better chance of recovery.

Anomalous Dislocations.—Of the rare displacements of the shoulder there are several varieties, of which the best known is the one originally described by Sir Astley Cooper as a *partial* luxation of the head of the humerus, the bone lying upon the anterior part of the neck of the scapula, underneath the coracoid process, being thrown off from the glenoid cavity inwards and slightly downwards. Malgaigne has more recently given an account of it under the name of the *subcoracoid* dislocation. The accident is exceedingly uncommon. It is caused by a violent fall upon the hand or elbow, at a moment when the limb is carried backwards beyond the line of the body and a little away from the side. The anterior part of the capsular ligament is ruptured, but the muscles and tendons round the joint sustain comparatively little injury, as they are subjected to much less tension than in the complete luxations of the shoulder.

Some diversity of opinion exists as to whether this dislocation should be considered as a partial or as a complete one; some contending that the head of the humerus does not entirely abandon the glenoid cavity, while others assert that it does. Without positively denying that the latter occurrence is impossible, I am strongly inclined to believe that the displacement can seldom be complete, on account of the check

offered by the coracoid process to the progress of the bone as it is being impelled downwards and inwards. In the case described by Sir Astley Cooper, which was one of long standing, and the only one, I believe, that has ever been examined after death, a new articular cavity was formed in the subscapular fossa, but not completely outside of the glenoid cavity, showing that the latter had not been wholly abandoned by the head of the humerus.

The *symptoms* of this dislocation are not so well marked as in the complete varieties. It is only in very thin subjects that the head of the humerus can be very distinctly perceived in its new situation, or felt rolling about upon rotating the limb. The deltoid is less flattened than in ordinary cases, and the hollow below the acromion is also much less, the extremity of the process not standing out so conspicuously. The elbow is carried backwards and slightly away from the side, and all attempts to elevate it are found to be abortive, in consequence of the head of the humerus hitching against the coracoid process. The limb is generally represented as being a little shortened; but, if this be so, the change must be very slight, and can be of no diagnostic value.

The *reduction* is effected upon the same principles as in the other forms of displacement; but in this case it is necessary to make the extension, at first, more in the line of the luxation, in order to disengage the head of the humerus from the neck of the scapula.

Professor Willard Parker, in 1852, described a case of luxation of the shoulder-joint, in which the head of the humerus was thrown into the *subscapular fossa.* The accident happened while the patient, a young man aged twenty, was at work in a woollen-factory, his right arm being caught between the belt and drum, while the machinery was in rapid motion, and violently rotated outwards. When the limb was liberated, it was found lying diagonally across the body, in a state of strong, fixed pronation; the rotundity of the shoulder was lost; and the head of the bone could be distinctly felt beneath the scapula. The reduction was effected by carrying the arm outwardly at a right angle with the body, and then pulling the hand and wrist, so as to force the head of the humerus into the axilla, whence it was afterwards easily raised into its proper situation.

Larrey has described a preparation which he observed in the medical museum at Vienna, in which the head of the humerus had penetrated the chest, through the third rib, so as to form a tumor within its cavity. The accident had been produced by a fall upon the elbow, which was at the moment separated from the side of the body. In a case reported by Laugier, the bone was turned directly forwards, resting against the outer margin of the coracoid process. The great tuberosity corresponded to the glenoid cavity, and the limb exhibited a remarkably twisted appearance.

Double Dislocations.—Finally, there is occasionally a simultaneous dislocation of both shoulder-joints. Such an accident, however, of which interesting cases have been reported by Dr. W. H. Van Buren, Dr. Geddings, and others, is exceedingly uncommon. The head of each bone is generally forced down into the axilla, or one occupies

this situation and the other the chest beneath the pectoral muscles. The dislocation, which is sometimes complicated with fracture of the scapula and humerus, is usually caused by a fall, in which the person stretches out both hands to save himself from injury. In a case treated by Sir George Ballingall, of Edinburgh, the accident occurred during an epileptic fit; and in another, recorded by Dr. Nathan Smith, of New Haven, in an attack of puerperal convulsions.

The reduction in the double dislocation is effected upon the same general principles as in the single variety. In Smith's case, just referred to, replacement is said to have been effected at the end of seven months. In a case recorded by Fischer, of Prussia, the patient, a stout, athletic man, restored the parts to their proper position by his own efforts. Seating himself upon a high bench, he seized, simultaneously with both hands, a transverse beam above his head, and, throwing himself suddenly and forcibly from his seat, both bones instantly slipped into the glenoid cavities with a crackling noise. In Dr. Van Buren's case, the man died in five hours after the accident from injury of the skull and brain. The particulars of the case, with a resumé of six others, observed by different surgeons, will be found in the New York Journal of Medicine and Surgery, for November, 1857.

After-treatment.—The after-treatment of dislocations of the shoulder requires particular attention. In the first place, it is highly important to guard against a recurrence of the accident, which is so liable to happen after all injuries of this kind, especially after luxation into the axilla. Generally, all that is necessary for this purpose is to support the elbow, forearm, and hand for some time in a sling close to the side of the body; or, if the patient be restive, the arm may be secured to the trunk, over a small pad, by six or eight turns of a bandage. Full elevation, abduction, and rotation of the limb should not be permitted for five or six weeks, or until there is reason to believe that the capsular ligament and muscles have been in great degree repaired. The resulting inflammation is treated upon general principles. Passive motion, the cold douche, and liniments will be required to prevent anchylosis.

Accidents.—Dislocations of the shoulder are sometimes followed by *paralysis* of the arm, or, rather, of the deltoid muscle, produced by injury done to the axillary plexus or circumflex nerve by the head of the humerus. In the event of its being slight, the affection may get well spontaneously, or with the aid of stimulating liniments, veratria ointment, and counter-irritation, especially vesication; but in its more severe forms, as when it depends upon contusion and partial disorganization of the nerves, it often proves very refractory, and may even be incurable.

Another unpleasant effect which now and then succeeds dislocations of the shoulder, is *œdema* of the corresponding extremity, arising from the pressure of the head of the humerus upon the axillary veins and lymphatics; this, however, rarely lasts beyond a few days, and generally disappears spontaneously or under very simple means.

A sudden development of *emphysema*, first noticed by Desault, and since by several other observers, is sometimes met with after this accident, and is well calculated to create unpleasant apprehensions in

the mind of the attendant. Its cause has not been satisfactorily accounted for, but it is not reasonable to suppose that it can be anything else than a slight wound of the chest, from fracture of a rib, penetrating the pleura and lungs. This idea is countenanced by the circumstance that the starting point of the emphysema is always under the pectoral muscles, from which it rapidly spreads to the axilla, the whole extent of which it soon occupies. It may readily be distinguished from an extravasation of blood, consequent upon rupture of the axillary artery, by its elasticity; by the continuance of the pulse at the wrist, by the natural appearance of the skin, and by the production of a crackling noise when the part is pressed with the finger. Astringent lotions and gentle compression are the proper remedies.

Finally, the accident is sometimes attended with a rupture of the *axillary artery*, leading to copious infiltration of blood, or, when the lesion affects only the inner tunics of the vessel, to the formation of an aneurism. In either case, of the latter of which a remarkable one was observed by Nélaton, the proper treatment, after the reduction of the luxation, would be the ligation of the subclavian.

Chronic Dislocations.—Chronic dislocations of the shoulder are often brought under the notice of the surgeon, and the question therefore arises, at what period after their occurrence should he refrain from an attempt at reduction? Upon this subject I do not think it possible to lay down any definite rules. I have myself been foiled at the end of the sixth week, and I have known the same thing to happen to several practitioners of great skill and experience. On the other hand, I have succeeded, in one case, at the seventy-second day, and in another at the expiration of the third month. Physick succeeded in a number of instances after two and three months; and examples of from four to seven months' standing have been reported by McKenzie and Jameson, of Baltimore, Dorsey and Gibson, of this city, and by other American surgeons. The late Dr. Nathan Smith effected reduction, in one case, nearly one year after the occurrence of the accident. These instances are certainly very encouraging, but they should, nevertheless, be received with great caution, especially when it becomes necessary to view them in the light of examples for our imitation. It should never be forgotten, as has been stated elsewhere, that the greatest possible differences prevail in regard to this subject; that in one case a dislocation may become irreducible in several weeks, and in another not under several months, depending upon the individual circumstances of each. For want of this precaution, science has to deplore the sacrifice of a number of lives, in consequence of the rupture of the axillary artery in injudicious attempts to effect restoration long after the period for such an attempt had passed by. The disastrous cases recorded by Loder, Cooper, Pelletan, Flaubert, Bell, Gibson, and others, should serve as a warning to every surgeon how he interferes in accidents of this nature.

Perhaps the best plan that can be adopted in these chronic cases is to be guided by the degree of motion that has been acquired by the luxated bone. When this is considerable, it may be assumed that it has succeeded in establishing for itself a new joint, which it might be

dangerous to disturb on account of its important relations with the surrounding parts. Another consideration which should have its weight in these cases is the amount of inflammation by which they are followed; if this have been unusually violent, it may be inferred that there has been copious plastic effusion, filling up the original socket, and causing extensive adhesions among the muscles and vessels, matting them firmly together, and rendering interference hazardous.

When it is thought advisable to attempt reduction, the rules already laid down in the opening section upon dislocations, must be carefully observed; that is, a certain amount of preliminary treatment should be instituted with a view of facilitating the breaking down of the abnormal adhesions between the head of the displaced bone and the surrounding parts, and thus lessening the danger both of failure and of injury to the axillary vessels and nerves, after the application of the extending and counter-extending forces. In general, a resort to the pulleys will be required, and, in some cases, the apparatus of Dr. Jarvis might possibly be advantageously used.

Congenital Dislocations.—Congenital dislocation of the shoulder-joint is sometimes observed. The accident has been particularly studied by Mr. Robert W. Smith, of Dublin, who has directed special attention to it in his admirable work on fractures, published in 1847. Since then the malformation has been examined with much care by Gaillard, Guérin, Nélaton, and others.

The lesion may be single, or symmetrical, that is, it may occur on one side only, or on both; and there are cases in which it coexists with similar displacement in other articulations. Only two varieties of this malformation have hitherto been recognized by dissection, termed, by Mr. Smith, the subcoracoid and the subacromial, the head of the humerus in the former being lodged beneath the coracoid process, and in the latter on the dorsal surface of the scapula, below the outer and posterior part of the acromion. The latter might, perhaps, more properly be called the infra-spinous form of the luxation.

The symptoms of both these dislocations are well marked. In the *subcoracoid variety*, the shoulder has a flattened appearance, especially at its upper and posterior aspect, the acromion is unnaturally sharp and prominent, there is a remarkable hollow in the supra-spinous fossa, and the head of the humerus can readily be felt beneath the coracoid process, forming a distinct ball, which promptly obeys the movements of the elbow. The arm, which hangs along the side, is greatly withered, thus singularly contrasting with the forearm and hand, which generally retain their full development, being in fact quite as well conditioned as the opposite limb. The movements of the scapula are perfectly normal, while those of the arm are either annulled, or very much impeded, especially abduction; the forearm can be bent, but not actively extended. The movements, on the contrary, of the hand and fingers are nearly, if not entirely, natural.

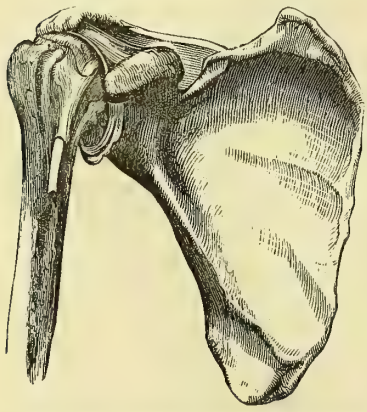
In the *subacromial* dislocation the head of the humerus may be easily felt on the dorsum of the scapula, a short distance below the

root of the acromion, where it forms a distinct, unmistakable prominence. The deltoid muscle is flattened externally and in front; the acromion is uncommonly salient; the arm, shortened and withered, is rotated inwards towards the trunk; and the forearm and hand are slightly pronated, supination being executed with great difficulty.

The *treatment* of these dislocations must be conducted according to the general principles laid down in a previous page. In a remarkable instance observed by Gaillard, that surgeon succeeded in effecting the reduction of a congenital luxation of the shoulder-joint in a girl sixteen years of age, the patient recovering with a most excellent use of the arm. For several weeks prior to the operation, the parts were daily subjected to passive motion and manipulation, so as to induce them to yield the more readily to the necessary extension and counter-extension. The inflammatory symptoms that followed the reduction were combated by the usual means.

Dislocations of the Tendon of the Biceps.—The tendon of this muscle is liable to be dislodged, being violently wrenched from its bed in the humerus, and perhaps partially torn, if not completely snapped asunder. In the latter case, the upper extremity of the tendon may float loosely about within the joint. The accident generally happens from falls or blows upon the shoulder, forcing the humerus away from the glenoid cavity of the scapula, generally upwards and inwards against the coracoid process, or forwards against the ribs. The accident may also occur from falls on the hand or elbow, especially if, at the moment, the limb be very much twisted upon its axis. The nature of the lesion is always obscure, and therefore very apt to be overlooked, or to be mistaken for dislocation, fracture, or sprain of the shoulder. The most prominent symptoms are, inability to flex the arm from the loss of power in the biceps, and pain at the seat of the injury, either alone, or united with partial displacement of the head of the humerus. Reduction should be attempted by thorough relaxation of the muscle by bending the forearm at a right angle with the elbow, and then pressing the tendon back into its proper place with the fingers. The after-treatment should be strictly antiphlogistic; otherwise there will be great danger of permanent anchylosis of the joint. If the tendon be completely severed, the limb will always be weak. In the adjoining drawing (fig. 272), from a preparation of Mr. Soden, the tendon of the muscle lay with its sheath on the lesser tubercle of the humerus.

Fig. 272.



Dislocation of the tendon of the biceps muscle.

3. INFERIOR EXTREMITY.

DISLOCATIONS OF THE FOOT.

Luxations of the *phalangeal* and *metatarso-phalangeal* joints are uncommon, and are mostly of so complicated a character as to require amputation. The reduction is always easy.

Of dislocation of the *great toe* at the metatarsal joint, a very uncommon accident, I have seen two cases, one recent and the other old. The following is a brief history of them.

A gentleman, aged forty-two, while walking along the pavement, slipped with his right leg through the hole of a coal cellar. The dorsal surface of the foot striking against a lump of coal, bent the great toe downwards and dislocated it at the metatarso-phalangeal articulation. The accident was productive of considerable pain, and was so well marked as to be at once recognized. The toe was inclined somewhat outwards, and lay a little higher than in the natural state. It was fully half an inch shorter than the sound one. The head of the first phalanx rested upon the dorsal surface of the anterior extremity of the metatarsal bone, where it formed an abrupt, well defined prominence. The projection on the plantar surface, formed by the head of the metatarsal bone, was less conspicuous. The adductor muscle of the great toe formed a broad, tense cord at the inner side of the foot, which disappeared on the reduction, having been caused by the retraction of the toe. I saw the man within an hour after the accident, when there was no swelling or discoloration of the parts.

The patient being placed under chloroform, I applied a clove-hitch knot to the toe, and steadily drew it into place, the extension being made forwards, and slightly downwards, to disengage the head of the phalanx from the anterior extremity of the metatarsal bone. The foot was steadied by an assistant grasping the ankle.

In the other case the accident was occasioned by the foot being caught between two steamers, which twisted off the man's boot, severely wrenching the limb, and bruising the soft parts. The phalanx of the big toe was forced below the metatarsal bone, forming a large prominence in the sole of the foot, which has ever since, now a period of six years, been a source of much annoyance, being frequently so sore and tender as to interfere materially with progression.

The *reduction* of this luxation is occasionally attended with considerable difficulty, depending probably upon the manner in which the adductor muscle and the sesamoid bones are dragged by the displaced phalanx backwards over the extremity of the metatarsal bone. In the event of such a contingency, I should endeavor to effect restoration by means of Dr. Crosby's plan of reducing dislocations of the thumb, raising the toe perpendicularly, and then applying strong pressure against its base, so as to push it from behind forwards, and from above downwards.

The *metatarsal* bones are rarely dislocated, owing to the firmness of

their connections both with each other and the lower row of carpal bones. The accident is most commonly compound. A simple luxation, however, of one or more of these bones is sometimes occasioned by a violent wrench of the foot, or by the passage of the wheel of a carriage, as happened to me in a case a good many years ago, in which the fourth and fifth metatarsal bones were detached from their connection with the cuboid bone, and thrown upwards upon the tarsus. The reduction was effected with great facility, and, under the employment of leeches and other antiphlogistics, the man was able in the course of a fortnight to exercise on crutches, regaining eventually a good use of his limb.

The only case of a complete dislocation of all the metatarsal bones from the tarsal of which I have any knowledge, was communicated to me in 1857, by Dr. Traill Green, of Easton, Pennsylvania, as having occurred under his observation and that of Dr. Edward Swift. The patient, a medical gentleman, aged sixty-five, had fallen down a flight of stairs, injuring the left foot, which was found soon after the accident to be much swollen over the arch and very painful, with deformity at the inner and outer edge. The metatarsal bone of the great toe was separated from the internal cuneiform bone, and thrown over towards the outer margin of the foot, leaving the latter bone quite prominent at the inner side. A similar condition existed on the opposite side, the metatarsal bone of the little toe being thrown off completely from the cuboid bone, so as to present a well-marked projection at the outer border of the foot. In short, the twisted state of the foot, the great deformity, and the swelling of the arch, all clearly indicated a lateral displacement of all the metatarsal bones.

The *reduction* was easily effected in the following manner. The patient being placed in a half reclining posture on a settee, with his right foot against the arm to brace himself during the operation, an assistant applied his knee to the instep, and while he made extension by grasping the dislocated portion of the foot, previously surrounded by a wet roller, to prevent the lac from slipping, Dr. Green, who supported the leg upon his thigh, made strong lateral pressure, in a direction contrary to that of the displacement. The parts soon began to yield, and in a few minutes returned to their proper place with a distinct snap, all deformity at the same time disappearing.

Dislocation of the *tarsal* joints are uncommon, their limited motion and the strength of their ligaments disqualifying them for disunion. The astragalus is almost the only bone which is liable to displacement, and this accident is also unusual.

Dislocation of the *cuneiform* bones is extremely infrequent. The internal one of these pieces is more apt to suffer than either of the other two. The accident is usually caused by falls from a considerable height, in which the person alights upon the sole of the foot, the force separating the bone from its natural relations. A projection on the inside of the foot, and a slight elevation of the bone, from the action of the anterior tibial muscle, are the characteristic signs of the lesion. The reduction, which is difficult, is effected mainly by pressure. In two cases of this luxation mentioned by Sir Astley Cooper, replace-

ment was found to be impracticable. In general, when this happens, the patient, in time, regains a tolerably good use of the limb.

Retention is maintained by adhesive strips, a compress, and bandage, aided by splints, to keep the foot in a quiet, easy position. When the inflammation has sufficiently subsided, a leather strap with a soft pad should be worn, to protect the parts until the reparative process is completed.

The *scaphoid* and *cuboid* bones are occasionally separated from their connections with the astragalus and calcaneum, in consequence of the falling of a heavy weight, or of a person jumping from a considerable height and alighting upon the sole of the foot. Under these circumstances the foot is shortened and twisted upwards and inwards, forming a remarkable prominence upon the instep, which gives it a distorted appearance not unlike what occurs in varus. The accident is extremely infrequent, and is easily remedied by fixing the leg and heel, and then drawing the toes outwards, in a direction contrary to that of the displacement. Suitable retentive means will, of course, be required to prevent a recurrence of the luxation.

The *calcaneum* has been found dislocated from the cuboid bone laterally, in an outward direction, from causes similar to those producing displacement of the other tarsal bones. The accident is easily detected and remedied by manipulation.

A remarkable instance of dislocation of the five anterior *tarsal* bones from the astragalus and calcaneum has been recorded by Sir Astley Cooper, as having occurred in a laboring man, in consequence of the fall of a very heavy stone. The foot was singularly distorted, exhibiting very much the appearance of a club-foot, the forepart being turned inwards upon the astragalus and calcaneum, so as to give the limb an arched shape. The reduction was easily effected by fixing the leg and heel, and pushing the luxated bones in a direction contrary to that of their displacement. A similar case has been recorded by Petit.

In the succeeding pages an account will be given of luxations of the *astragalus* from the mortise-like cavity of the tibia and fibula, and, without anticipating, in any way, what will then be said, it is important to bear in mind that the class of lesions which are now to be considered, is very different from that of the ankle-joint, in which the bone in question plays so conspicuous a part. In the latter affections the astragalus is torn off simply from its connections with the tibia and fibula, but in those which are next to be described, it not only loses its relations with those bones, but also with those of the calcaneal and scaphoid bones. The displacement may either be partial or complete, the astragalus in the former case still retaining some of its connections, whereas, in the latter, they are entirely lost, complete disruption having taken place, or, in other words, the bone is lifted bodily out of its original position, into one altogether new. It is obvious that such an accident can only occur in consequence of the application of excessive violence, in which the foot is strongly extended upon the leg, and more or less rotated upon its axis. Hence it is always of a grave nature, and rarely unaccompanied by fracture of the inferior extremity of the

tibia and fibula, which thus adds still further to its complications and dangers. Occasionally, indeed, the astragalus itself is severely shattered.

Dislocation of the astragalus may take place in two directions, backwards and forwards, the latter, which is by far the more frequent of the two, admitting also of a certain degree of displacement laterally, or to either side, in consequence of a twist of the foot. In the posterior luxation the bone does not experience any rotation; hence it is more in the course of the median line, suffering no material lateral deviation.

In the luxation *backwards*, of which only a few cases are known as having occurred, the astragalus is thrown behind the ankle, resting upon the superior surface of the calcaneum, where it forms a large characteristic prominence. The tendo-Achillis is pressed strongly backwards by the displaced bone, there is great tension of the skin of the heel, the muscles of the calf are very rigid, the tibia is slightly pushed forwards, and the instep appears a little shorter than natural. In general, also, there is a slight vacuity in front of the joint. The tibia and fibula are sometimes both fractured.

The *reduction* of this luxation is attended with immense difficulty, owing to the manner in which the surfaces of the astragalus and calcaneum are interlocked with each other, and I am not aware that the operation has ever succeeded, except in one case, which occurred to Mr. Liston, and in which the accident was attended with fracture of the tibia and fibula, which had probably the effect of rendering the parts more movable. In attempting to replace the bone, the leg and foot should be as strongly flexed as possible, so as to induce thorough relaxation of the gastrocnemial muscles, and then, while extension and counter-extension are made by means of the clove-hitch, the astragalus should be urged from behind forwards into its natural position. When the difficulty is very great, the parts absolutely refusing to yield to any efforts, however judiciously applied, recourse may be had to the subcutaneous section of the tendo-Achillis, in the hope of thereby promoting restoration. The operation has recently succeeded in quite a number of cases.

When reduction fails, the patient will in time acquire a tolerably good use of his limb, the parts accommodating themselves gradually to their new relations. In one instance, where the attempts proved unsuccessful, the bone caused sloughing of the soft structures, and was obliged to be extracted.

The luxation *forwards* is generally incomplete, the anterior half of the bone, or a little more, resting upon the dorsal surface of the scaphoid bone, while the posterior half is imbedded in the hollow between the two articulating surfaces of the calcaneum. The displaced bone forms a distinct prominence over the instep, while a marked vacuity exists at the inner part of the foot, just below the corresponding malleolus. The tibia and fibula either retain their natural position, lying upon the posterior surface of the astragalus, or, as more commonly happens, they are carried slightly forwards, thus increasing the length of the heel, and inclining the foot towards one side or the other, according to the peculiar relations which the bone may sustain towards

the calcaneum, a trifling change of position being capable of determining the nature of the lateral displacement.

In the complete form of the accident, the bone is forced away entirely from its natural position, being tilted up in front of the joint so as to rest upon the scaphoid and cuneiform bones. The signs are characteristic, the large prominence at the instep, the constrained and twisted position of the foot, the shortening of the leg, and the descent of the malleoli towards the sole of the foot, together with the elevation and lengthening of the heel, being sufficient to reveal its nature at a glance.

Sometimes the position of the astragalus is almost completely reversed, and there are few cases which are unattended with fracture of the tibia and fibula, or even of the astragalus itself. Moreover, the dislocation is not unfrequently of a compound character, the soft parts being severely lacerated, and the wound extending into the ankle and tarsal joints; or, when such an effect has not been the direct result of the accident, the foot is soon reduced to that condition by the ulceration and sloughing caused by the pressure of the displaced bone upon the integuments of the instep.

The great obstacle to *reduction* in this as in the backward dislocation is the malposition of the astragalus, or the change in its axis, which not unfrequently baffles all the efforts of the surgeon at restoration, however well directed or perseveringly continued. Even when the displacement is only partial, the difficulty will generally be very great, though not as much so as in the complete form, where it is usually insurmountable, all attempts at reposition proving abortive. In the latter case, indeed, it is questionable whether, after what experience has taught us upon the subject, it will be judicious hereafter to make any efforts at reduction, seeing how much all such trials, rough and protracted as they necessarily must be, must tend to aggravate the injury, and thus increase the risk of undue inflammation. When the displacement is partial, I would certainly strongly urge the employment of reductive means, consisting of traction and pressure, aided, if the case proved rebellious, by the subcutaneous section of any ligaments and tendons that might seem to act obstructingly. When replacement is impracticable, the tension of the parts should be relieved by subcutaneous incisions, as this will lessen the risk of sloughing and exposure of the bone, a circumstance inevitably productive of necrosis, and the necessity of partial excision. When such an accident can be prevented, it is consoling to know that, as in dislocation backwards, the bony surfaces become gradually adapted to each other, thereby ultimately permitting a tolerably good use of the limb.

When the bone is entirely displaced, lying immediately beneath the integuments and muscles of the instep, I am satisfied, from a careful study of the subject, that the only safe course of treatment is immediate excision, the ends of the tibia and fibula being placed in the sulcus vacated by the removal of the astragalus, and the edges of the wound being carefully approximated by collodion, so as to insure their prompt reunion without risk of suppuration. The operation, however, is not free from difficulty, as is exemplified in a case by Dupuytren, in

which that great surgeon succeeded in removing the bone only after a long and tedious dissection. The trouble arose from the pulley-like surface of the astragalus being turned downwards, while its posterior projecting part was hooked in under the tibia.

In *compound* dislocations a similar procedure is proper; but here, if the complication be at all grave, the question of amputation will necessarily arise, and much judgment will generally be required to make a just decision. In all severe cases, involving extensive lesion both of the soft structures and of the bones, especially when occurring in weakly or sickly subjects, no experienced surgeon would for a moment hesitate as to the propriety of removing the limb; the only doubt that could possibly arise would be, whether the operation should be done through the leg or through the foot, according to Pirogoff's method.

The *after-treatment* of these cases requires no special mention. The great points are to give due support to the limb, and to moderate the resulting inflammation by the bandage, leeches, and medicated lotions; and, eventually, by the institution of passive motion, to prevent union between the calcaneum and bones of the leg. If erysipelas should appear, as in severe cases it is very prone to do, early and free incisions will be necessary.

DISLOCATIONS OF THE ANKLE.

Dislocations of the ankle-joint are among the most infrequent of traumatic lesions, the mechanism of the articulation being eminently unfavorable to their occurrence. The length and width of the malleoli, render lateral displacement of the astragalus almost impossible without concomitant fracture of one or both of these projections, while luxation in the antero-posterior direction is nearly as impracticable in consequence of the extraordinary strength and firmness of the ligaments connecting that bone to the tibia and fibula. The effect is that these injuries are almost always of a complicated character, their chief interest depending upon the violence done to the neighboring structures. Most of them, in fact, should be viewed in the light rather of fractures of the tibia and fibula, with displacement of the astragalus, than as dislocations, properly so called, of the ankle-joint. After a very careful examination of the records of surgery, I find that simple displacement of this bone, in any direction, is an occurrence of such extreme infrequency as hardly to deserve mention.

The dislocations of the ankle-joint are four in number, the foot being susceptible of being thrown forwards, backwards, inwards, and outwards. In addition to these displacements a few cases have occurred of luxation of the astragalus upwards, this bone having become wedged in between the lower extremities of the tibia and fibula; and Huguier has published the particulars of one where the foot was turned completely outwards, the toes forming a right angle with the leg, and the external malleolus representing the heel.

The *nomenclature* of these luxations has been the subject of a singular caprice, and, in consequence, the result of no little confusion. Instead of considering the astragalus as the dislocated bone so as to

place this joint in the same position, in this respect, as the other articulations, Sir Astley Cooper and others, adopting his example, have made it the fixed point and the tibia and fibula the movable. This manner of viewing these lesions has occasioned a corresponding change of nomenclature, and as both are radically defective, serving only to embarrass the progress of the student, they should be discarded.

1. Luxation *forwards*, the most infrequent of all, arises from falls on the heel, while the foot is greatly bent upon the leg, the body being at the same time inclined forwards, so as to throw the strain upon the forepart of the joint. Under these circumstances the ligaments are extensively ruptured, the astragalus escapes from the mortise-like cavity of the tibia and fibula, resting immediately in front of the former bone, where it forms a large projection, readily perceptible just beneath the integuments. The diagnostic signs are, the elongated state of the foot, the distance between the leg and toes being materially augmented, the remarkable shortening of the heel, and the effacement of the depressions behind the ankle in consequence of the close approximation of the tendo-Achillis to the posterior surface of the limb.

The *reduction* is effected mainly by manipulation. As a preliminary step, the leg is flexed at a right angle with the thigh, to relax the gastrocnemial muscles, when an assistant, seizing the lower part of the leg, gradually pushes it forwards, while the surgeon, grasping the foot, and bending it considerably, forces it backwards, in the opposite direction. When the case is rebellious, recourse may be had to the subcutaneous division of the tendo-Achillis, which greatly facilitates restoration.

2. Dislocation of the ankle joint *backwards* is caused by violence applied to the anterior extremity of the foot while it is immoderately extended, the knee being at the same time strongly flexed and projected forwards; or, the foot and leg being in this position, it may arise from a severe blow upon the lower and back part of the limb, the two forces driving the articulating surfaces in opposite directions. The displacement is ordinarily accompanied by fracture of the inferior extremity of the fibula.

The *signs* are characteristic, being the reverse of those which distinguish dislocation forwards. The dorsal surface of the foot is shortened, the toes pointing downwards; the heel is elongated and firmly fixed; the tendo-Achillis, being pushed far back beyond its natural position, stands out in bold relief; the pulley-like surface of the astragalus is readily perceptible at the back part of the inner ankle; and the extremity of the tibia forms a hard prominence upon the instep, immediately beneath the integuments.

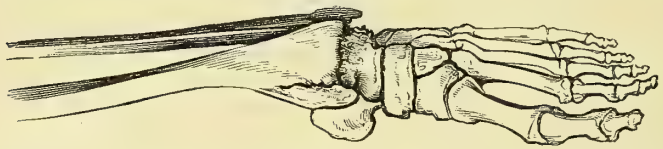
The restoration is accomplished in the same manner as in the luxation forwards, the gastrocnemial muscles being thoroughly relaxed, and the bones pulled and pushed in opposite directions.

The dislocation backwards is sometimes *incomplete*, one-half of the articular surface of the tibia resting upon the scaphoid bone and the other half upon the astragalus. The foot is pointed downwards, and cannot be put flat upon the ground, and the heel is raised and abnor-

mally prominent, but less so than in complete luxation. A careful examination of the joint will at once reveal the true nature of the case.

3. Luxation *inwards*, which is the less frequent of the lateral displacements of the ankle-joint, is generally occasioned by falls or blows upon the foot, in which the astragalus is violently rotated upon its axis, and thrust against the inner malleolus, which is usually broken in consequence, being separated obliquely from the extremity of the tibia (fig. 273). It is also liable to be produced by direct injury, as that caused

Fig. 273.

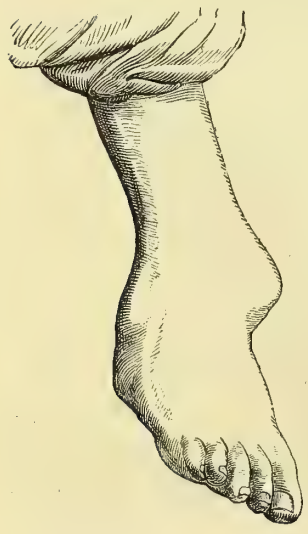


by the passage of the wheel of a carriage. Sometimes the luxation is also associated with fracture of the astragalus, or of this bone and the fibula, thus greatly aggravating the case.

The articular surface of the astragalus, pointing immediately below the internal melleolus, can be easily perceived in its new position; the foot is turned inwards, its outer border resting on the floor, while the inner is proportionably raised; and there is a remarkable prominence at the outer part of the joint, formed by the extremity of the fibula.

In reducing this dislocation, the leg is bent at a right angle with the thigh, and steadied by an assistant, while traction is made upon the foot, and the astragalus pushed back into its natural position. Apposition of the articular surfaces is maintained by means of two side-splints, or, what I prefer, by a tin case, well fitted to the size and shape of the limb, it being all important to afford the foot proper support until reparation has taken place.

Fig. 274.



4. Dislocation of the joint *outwards* (fig. 274) is the most frequent of all the displacements to which this articulation is exposed, a sudden twist of the leg, while the foot is firmly fixed, being the most common exciting cause, although it is often produced by direct violence. The articular, pulley-like surface of the astragalus is forced below the outer malleolus, and there is always fracture of the inferior portion of the fibula; without this, indeed, the occurrence would seem to be impracticable. This form of luxation has been described by most authors as displacement inwards.

In this variety of the accident, both malleoli are sometimes broken off, in consequence of which the superior surface of

the astragalus slips away from the articulating surface of the tibia, and places itself in the gutter between this bone and the fibula. The foot, in this case, is nearly flat, as the patient stands up, with a slight upward inclination of its inner margin, and the lower extremity of the tibia forms a remarkable prominence, rendered the more conspicuous on account of the displacement of the internal malleolus, which is drawn over towards the fibula. Great deformity also exists on the outer border of the ankle, caused by the projection of the inferior fragment of the fibula.

The *signs* of this luxation are unmistakable. The internal malleolus is thrown inwards, forming a remarkable projection under the integuments; the foot has a twisted appearance, and is easily rotated upon its axis, its inner border resting on the ground; a considerable depression exists on the outer surface of the leg, a short distance above the joint, corresponding with the line of fracture of the fibula, and the astragalus can be distinctly perceived below the external malleolus.

The *reduction* is effected by flexing the leg strongly, so as to relax the gastrocnemial muscles, and then drawing the articulating surfaces towards each other in a direction contrary to that of their displacement. The whole procedure is one of great simplicity. Maintenance is preserved by means of adhesive strips, so arranged as to keep the ends of the broken fibula in a straight line, and the articulating surfaces of the displaced bones in close apposition, due support being afterwards given to the foot by a tin case or two side splints.

In the dislocation *upwards*, of which not more than a few cases exist in the records of surgery, the astragalus is forced upwards between the two bones of the leg, the fibula being fractured some distance above the joint, and widely separated from the tibia. The astragalus preserves its natural direction, but is so firmly impacted as to render its restoration a matter of difficulty. The two malleolar projections are extremely prominent, and descend nearly as low down as the sole of the foot, which is usually inclined a little to one side.

The luxations now described are all, it will be perceived, more or less complicated in their character, and, therefore, require the most assiduous care and attention during the after-treatment to prevent anchylosis. Anodyne and astringent lotions, and, in the more severe forms, free leeching, will be necessary to keep the inflammation within due limits. Proper support, in an easy posture, must be given to the leg and foot until all danger of displacement is passed. Passive motion and sorbefacient remedies will complete the cure. In most cases, however, the joint will long remain weak, and, in not a few, loss of motion, partial or complete, will take place in spite of all the care and skill that the surgeon can bestow.

The ankle is not unfrequently the subject of *compound* dislocations, the wound in the soft parts penetrating the cavity of the joint, and affecting, perhaps, the principal vessels and nerves of the limb, at the same time that there may be violent contusion of the integuments, and extensive comminution of the bones of the leg. In such a case, which

is well displayed in the annexed cut (fig. 275), from a preparation in my collection, the surgeon could not hesitate as to the course that ought to be pursued. Amputation alone can save limb and life, and should be delayed no longer than is absolutely necessary for the occurrence of the necessary reaction. The lesion is profound, and an attempt to preserve the parts would be worse than foolish. When the injury is less violent, and the constitution sound, conservative surgery will often effect wonders, and is always worthy of a fair trial. When the ends of the bone protrude, excision will, as a general rule, be the only safe course.

Fig. 275.



DISLOCATIONS OF THE TIBIO-FIBULAR JOINTS.

Dislocation of the tibio fibular joints is an extremely uncommon occurrence; for, independently of their peculiar mode of articulation, and the great firmness and strength of the connecting media, the resistance offered by the interosseous ligament, and the protection which the fibula receives from its relations with the tibia, are so many causes which interfere with the disruption of their surfaces. It is only, indeed, the most violent injury that can give rise to the accident. There is a form of dislocation of the upper joint which occasionally occurs as a result of excessive relaxation of the fibulo-tarsal ligaments, chiefly in weakly, delicate females, allowing the head of the fibula too much latitude of motion; but this is an occurrence very different from a real luxation, which is always occasioned by external force acting directly upon the component elements of the joint. Of the traumatic variety of the lesion, only a few examples are on record. Boyer has published the particulars of a case in which both joints were displaced simultaneously, the foot being at the same time dislocated outwards. Such an accident necessarily implies extensive laceration of the interosseous ligament, and can only happen by a fall upon the foot, or a blow upon the inferior extremities of the fibula, driving the bone upwards and outwards with the whole force of its leverage. Whatever may be the nature of the displacement, reduction is always easily accomplished by flexing the leg at a right angle with the thigh, and pushing the bone back in a direction contrary to that of its luxation. Maintenance, which is usually extremely difficult, must be effected by long-continued rest of the limb, and the use of a broad, elastic strap with a closely-fitting pad, acting directly upon the head of the bone.

In the *subluxation*, as it may be termed, of the upper tibio-fibular joint, the proper remedies are chalybeate tonics, with gentle exercise in the open air, and, locally, the cold douche and the tincture of iodine, followed by a series of little blisters, and the use of a proper supporter. If the case be rebellious, a delicate tenotomy knife may be introduced

subcutaneously, and carried about in the joint in different directions so as to scratch the articular surfaces, with a view to provoke effusion of plastic matter.

DISLOCATIONS OF THE PATELLA.

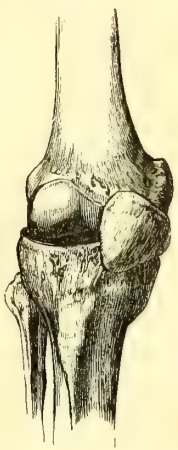
It is obvious, from the situation of the patella and the manner in which this bone is embedded in the tendon of the extensor muscles of the thigh, that it is susceptible of being dislocated only outwards and inwards, or laterally. Displacement downwards is altogether impracticable, while that upwards cannot happen without rupture of the ligament by which this bone is connected to the tibia. Either luxation may be complete or incomplete. A remarkable form of the accident has occasionally been met with, chiefly of late years, in which the patella is dislocated edgewise, vertically, or upon its axis. Whatever may be the character of the displacement, the occurrence is extremely uncommon; so much so, indeed, that many practitioners of large experience have never seen an instance of it. It is most liable to happen in thin, feeble persons, in whom it is usually produced by very trivial causes, such, for example, as a sudden twist of the limb in dancing, walking, leaping, or stepping into bed. When there is a faulty conformation of the knee-joint, attended with a relaxed state of the ligaments, it may take place spontaneously, from the action of the extensor muscles conjoined with slight rotation of the leg, the thigh being fixed in the straight position. Sometimes the displacement is occasioned by direct violence, forcing the bone towards the opposite side of the articulation, or twisting it upon its axis.

Fig. 276.



Of the two lateral dislocations, that *outwards* (fig. 276) is the more common; the patella lying at the external part of the joint, its outer edge being directed backwards, and the inner forwards. The signs are unmistakable. There is a remarkable depression in front of the knee, with a corresponding prominence on the outside; the inner condyle can be distinctly felt under the skin, and the leg is in a painfully extended position, without the possibility of being flexed.

Fig. 277.



Restoration is effected by placing the patient upon his back, and flexing the thigh upon the pelvis, the lower part of the leg resting upon the surgeon's shoulder, as he sits upon the edge of the bed. The object of this procedure is to relax the knee as completely as possible, when, pressure being applied to the bone, with the thumb and fingers, from without inwards, the patella will immediately be drawn into its natural position by the action of the extensor muscles.

In the dislocation *inwards* (fig. 277), the situation

of the patella is reversed, its inner border being turned backwards and the outer forwards. The leg is extended and cannot be bent; the outer condyle looks as if it were depressed, and a characteristic prominence exists on the internal aspect of the knee. The reduction is effected in the same manner as in the former case.

Although these lateral dislocations of the patella are generally reduced with great facility by the method here advised, yet cases occasionally occur in which the operation is attended with immense difficulty, the most accomplished surgeon being sometimes foiled for a long time in all his best directed efforts. It is said that Sabatur completely failed in an instance of this kind; and Dorsey, on one occasion, nearly experienced a similar fate. Being called to a young lady who had luxated her rotula in stepping into bed, he did not succeed in effecting restoration until after many fruitless attempts, although he saw his patient within five minutes after the accident. When the difficulty is unusually great, it may generally be surmounted by forcibly flexing the leg, and then rapidly extending it, a procedure which will have the effect of disengaging the bone from its impacted position by the side of the condyle of the femur.

The dislocation in which the patella is displaced edgewise, *vertically*, or upon its long axis, is altogether a singular accident, the very possibility of which was denied by nearly all surgeons until a very recent period. It is, indeed, difficult to conceive how a bone, which is so firmly embedded as this is in tendonous matter, can lend itself to such a freak, which has the effect of turning it completely on its side, so that its outer edge lies immediately under the integuments in front of the knee, while the inner rests in the sub-condyloid fossa of the femur, being firmly and almost immovably wedged in its new position, the anterior face looking inwards, and the posterior outwards. Sometimes the position of the patella is almost entirely reversed, the surfaces changing situations, the anterior looking backwards, and the posterior in the opposite direction. The occurrence, however, is very uncommon. Among the earlier of the reported cases was that of Dr. John Watson, of New York, in 1839, and another, of much interest, occurred soon after in the practice of Dr. J. P. Gazzam, of Pittsburg; the patient of the former being thirty-five years old, that of the latter, twenty-one. The details of a very interesting example of this rare dislocation of the patella, which recently occurred in the practice of Dr. Wragg, of South Carolina, will be found in the Charleston Medical Review, for May, 1856. The lesion is generally produced by violent muscular action, conjoined with a sudden and forcible twist of the knee; occasionally, however, it appears to be caused by a fall, or blow upon the bone, the leg being semiflexed, and strongly rotated upon its axis. In one of the recorded cases it happened while the person was engaged in wrestling.

The *signs* of this dislocation are characteristic. The leg is perfectly straight, but may occasionally be slightly flexed, though not without excessive pain; the patella forms by its outer edge a hard, prominent ridge in front of the knee; a deep depression exists upon each condyle; and the extensor muscles are in a state of great tension.

The *reduction* of this luxation has generally been found extremely difficult, owing, apparently, to the trouble which is experienced in disengaging the bone from the sub-condyloid fossa, where it is almost as firmly impacted as if it were screwed fast. On several occasions, indeed, the most violent efforts, conjoined with the division of the ligament of the patella, were hardly sufficient to accomplish the object. In the case mentioned by Dr. Gazzam, the only effect which the operation produced was to render the bone a little more movable, but the attempts afterwards to reduce it were just as unavailing as before. In another instance, the surgeon, Dr. Wolff, divided both the ligament below, and the extensor tendon above the bone, and yet he found it impossible to restore the parts to their natural relations. Violent disease of the joint ensued, and the patient at length perished from profuse discharge and hectic irritation. Fortunately, such measures are not likely to be again repeated, since experience has not only shown that they are inefficacious, but dangerous.

The proper method of reduction consists in flexing the thigh strongly upon the pelvis, and in bending the leg forcibly, and to the fullest extent, upon the thigh, the limb being again immediately brought into a straight line, at the same time that an effort is made to push the bone strongly over towards the inner part of the joint. By repeating this manœuvre several times, in rapid succession, the patella suddenly leaves the sub-condyloid notch, and jumps back, with a distinct snap, into its natural situation. Extension, even when carried to excess, does no good in effecting reduction; on the contrary, in every case in which it has been tried it has signally failed, having only apparently produced still farther impaction of the bone.

After the reduction of these different dislocations, the patient must be subjected for some time to rest and the usual antiphlogistic measures; and when he is able to move about, it will be necessary to support the joint for many months with a laced gum-elastic cap.

Displacement of the patella *upwards* can only occur when there is a rupture of the ligament of that bone, in consequence of the inordinate action of the extensor muscles, or violence applied to the anterior surface of the knee. The injury is easily recognized by the flattening of the joint, by the projection upon the inferior part of the thigh, and by the inability of the patient to extend the limb. The treatment is precisely the same as in fracture of the patella.

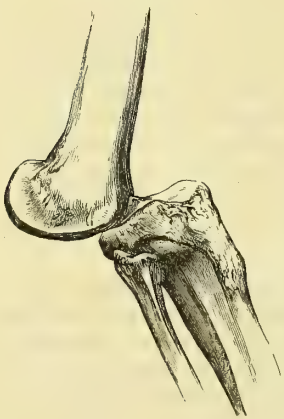
DISLOCATIONS OF THE KNEE.

Dislocation of the tibio-femoral articulation, or of the tibia from the condyles of the femur, is of very infrequent occurrence, owing, mainly, to the numerous and powerful ligaments by which their articulating surfaces are united together. In this respect, there is no other joint in the whole body so well provided. If it were not for this arrangement, luxation could hardly fail to be very common, as the knee not only admits of extensive motion, but has unusually shallow surfaces, with no very strong support from the neighboring muscles, such as we observe, for instance, in the hip, shoulder, and elbow.

The tibia may be thrown from the condyles of the femur in four different directions, namely, forwards, backwards, inwards, and outwards, or to either side. The latter two are the most common, and are always incomplete, owing to the great extent of the articular surfaces, and the difficulty of rupturing all the ligaments in the lateral direction of the joint. In regard to the dislocations forwards and backwards, it was generally supposed, until lately, that they were always complete, but the accurate researches of Malgaigne have proved that they are most frequently partial. Besides these displacements, the knee is subject to a species of sub-luxation, dependent upon a change of location of the semilunar cartilages. This, indeed, is more common than all the other forms of the lesion together, and is, therefore, of sufficient importance to demand separate notice.

1. Dislocation *forwards* (fig. 278) is occasioned by falls upon the foot while the knee is in a bent position, or by force acting upon the anterior and inferior part of the thigh, driving the femur backwards behind the head of the tibia; in either case, the occurrence will be promoted if, at the moment of the injury, the leg is slightly rotated on its axis, so as to increase the strain upon the joint.

Fig. 278.



The head of the tibia is pushed upwards and forwards, lying in front of the condyles, and generally presenting a somewhat twisted arrangement; the patella is drawn up beyond its natural level, into a sort of hollow, just above the tibia, and may easily be lifted up with the thumb and fingers; the tendon of the extensor muscles is much relaxed; and there is shortening of the leg from an inch and a half to two inches. The condyles of the femur are situated in the ham, where they form a large tumor, which gives the part an unusually prominent appearance, and which occasionally exerts such a degree of compression upon the vessels as to interrupt the circulation in the dorsal artery of the foot.

The complete form of dislocation of the tibia, whether forwards or backwards, must necessarily be attended by most extensive rupture of the ligaments of the joint, and is, therefore, always to be regarded as a very serious accident. When the condyles are impelled backwards with unusual violence, there will be great danger of laceration of the popliteal vessels, especially of the artery of that name, either in the shape of direct rupture, or of a partial destruction of its inner and middle tunics; occasioning, in the former case, copious subcutaneous hemorrhage, the pressure of which may finally cause gangrene of the limb; and in the latter, the gradual dilatation of the artery into an aneurismal tumor, the ultimate effects of which may not be less disastrous. In all cases, there is rupture of the popliteal muscle. When

the injury to the joint and the parts around is very grave, the danger to limb and life may be such as to require amputation; but, in ordinary cases, the patient will rapidly recover from the immediate effects of the lesion, and eventually obtain a useful limb, although it will remain weak for a long time.

The *reduction* is readily effected by counter-extending the thigh and pulling the leg somewhat backwards, the surgeon's arm resting in the ham, and pressure being made upon the head of the tibia.

The following case, the only one that I have ever seen of dislocation of the head of the tibia forwards, will afford a good idea at once of the symptoms of the accident, and of the proper method of reduction:—

A very large, fat woman, weighing nearly two hundred pounds, married, and forty-eight years of age, while engaged in feeding her poultry, sustained a severe fall in consequence of the sudden slip of the right foot, which, bending outwards, thus caused the whole weight of the body to be thrown upon the corresponding knee. I saw her four hours after the occurrence of the accident, when several fruitless attempts had already been made at reduction. The knee, which was very painful and a good deal swollen, especially on the inside, appeared to be unusually wide from side to side; a circumstance partly due to the tumefaction of the soft parts. The leg was one inch and a half shorter than the opposite one, and in a straight line with the thigh. The patella had sunk behind the head of the tibia, into a sort of hollow, which gave to the front of the joint a flattened appearance. Upon grasping the bone, however, with the thumb and fingers, it was easily drawn forwards, leaving a remarkable vacuity behind, in consequence of its distance from the inferior extremity of the femur. The condyles of the thigh-bone lay in the popliteal space, posterior to the head of the tibia, where they formed a large prominence, more distinct on the inside than on the outside, and situated, as it were, in the upper and back part of the leg, the muscles of which were unusually tense. The head of the tibia lay in front of the condyles, where its outlines could easily be traced with the eye and finger. Above this bone, as already stated, was the patella with its ligament and the tendon of the extensor muscles, forming a broad, thick cord in front of the thigh-bone, from which it was removed more than two inches. The leg was easily drawn away from its fellow, but could not be carried inwards, showing that there was extensive rupture of the internal lateral ligament. There was no contusion of the soft parts, nor any discoloration of the integuments.

Chloroform having been administered, a stout lac was applied to the upper part of the thigh, and confided to an assistant, to make the requisite counter-extension, while extension was made by another assistant grasping the foot, the limb being in the extended position. Placing now my left forearm behind the knee, and requesting the aids to pull gently and steadily, I suddenly, with my right hand, bent the leg backwards, and thus in a few seconds effected the reduction; the bone slipping into its proper situation with a distinct snap. The limb being placed in an easy position, cold cloths were applied to the

knee, and a grain of morphia administered to allay pain and prevent spasm.

No untoward symptoms appeared after the reduction. The patient kept her bed for nearly a fortnight, and medicated lotions were applied, after the first twenty-four hours, to moderate and subdue inflammation. Purgatives and light diet were also enjoined. In due time passive motion was instituted; the limb was frequently bandaged; and in less than a month from the time of the accident, the woman was able to walk about the house with the aid of crutches. The joint, however, remained weak for a long while, and even now, several years after the occurrence of the injury, the slightest fatigue is attended with temporary lameness.

2. Luxation of the tibia *backwards* (fig. 279) is so rare an accident that the possibility of its occurrence was called in question by many of the older surgeons. Modern experience, however, has not only shown the error of this opinion but has pointed out with great accuracy the mechanism, signs, and method of reduction of the displacement. The causes by which it is produced are similar to those which give rise to luxation forwards.

Fig. 279.



The head of the tibia lies in the popliteal region, where it compresses the vessels and nerves of that name, at the same time that it pushes back the popliteal and other muscles, and forms a distinct prominence, easily perceptible by the sight and touch. In front of the joint is the large projection representing the condyles of the femur, and immediately below these again is the patella, with a strongly marked depression on each side, its ligament being drawn tightly under the articular surface of the thigh-bone, and the tendon of the extensor muscles firmly stretched. The leg has the appearance of being slightly rotated, and is always considerably shortened, though less so than in the luxation forwards. In regard to its position, no definite rule can be laid down, as it varies much in different cases, being at one time in a state of flexion, and at another in a state of extension, both extremely uncertain in their extent.

The *reduction* is effected upon the same principles as in dislocation forwards, the thigh and leg being pulled in opposite directions, and pressure made upon the head of the tibia, while the patella is fixed by the hand in front.

3. The *lateral* dislocations of the tibia are always incomplete. They occur with nearly equal frequency, generally in consequence of falls, or of the passage of the wheel of a carriage, in which the femur is violently twisted while the leg itself is firmly fixed. Another cause is force applied to the lower and lateral part of the leg at a moment when the knee rests upon a hard, resisting object and the trunk is inclined sideways, thus throwing the whole strain upon the edge of

the joint. Much injury of the soft parts almost always attends these displacements, and the leg generally presents a remarkably twisted appearance.

In the luxation *inwards* (fig. 280), the head of the tibia is thrown off the corresponding condyle of the femur, and forms a large tumor at the inner side of the knee. In the displacement *outwards* (fig. 281), the signs are reversed, the tibia projecting at the external aspect of the joint, and the condyle at the inner. The leg, in both cases, is slightly flexed and rotated on its axis, the extensor muscles are relaxed, and a marked depression exists in the natural situation of the patella, which is pushed to one side or the other, according to the character of the displacement. The diagnostic signs are the twisted state of the limb, and the great increase of the width of the joint.

Fig. 280.

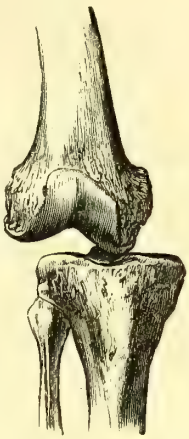
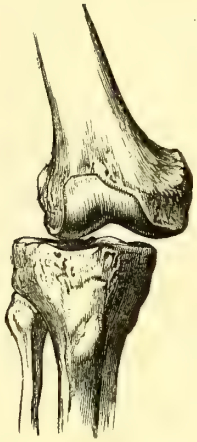


Fig. 281.



Owing to the extensive laceration of the ligaments of the joint, the lateral dislocations are reduced with great facility. All, in fact, that is necessary, is, while the thigh is fixed by an assistant, to pull the leg by grasping it just above the ankle, and to push the head of the tibia in a direction contrary to that of its displacement.

The *after-treatment* of all these luxations must be conducted upon strictly antiphlogistic principles. The patient should be confined to his bed for at least a month, and blood should be taken freely by leeches, and even by the lancet, if he be robust, or the inflammation run at all high. The great danger is anchylosis, which it will require the utmost care and diligence to prevent. The joint must be supported in an easy position, and passive motion must not be instituted too soon, lest it interfere with the reunion of the ruptured ligaments. When the patient is able to walk about, the knee must be protected with a laced-cap, and its tone improved by the cold douche, stimulating embrocations, and dry friction.

Compound dislocations of the knee are not of unfrequent occurrence, and are always to be dreaded on account of the constitutional sympathies which they are apt to awake. When the joint is freely laid open, and the soft parts are otherwise seriously injured, there can hardly be any doubt as to the propriety of immediate amputation, for such cases nearly always terminate unfavorably, the patient dying either of tetanus, pyemia, traumatic fever, or excessive suppuration; or, if he chance to recover, he will owe his life rather to his good luck than to the good management of his attendant. It is generally difficult to make the patient comprehend the importance of what will always

appear to him so harsh a measure, especially if he be a young man of temperate habits, and in excellent health at the time of the injury; he will resist the operation in spite of the arguments and entreaties of his surgeon, and will only consent when it is too late for him to be benefited. I am satisfied that there is no class of lesions more dangerous both to life and limb than compound dislocations of the knee, especially when at all severe; and I, therefore, do not hesitate to recommend the prompt adoption of decisive measures. Where the soft parts are not too much affected, resection may be advantageously substituted for amputation, though, in general, the latter is unquestionably the safer procedure.

DISLOCATION OF THE SEMILUNAR CARTILAGES.

The semilunar cartilages are subject to a species of displacement known under the name of subluxation, an affection which was first described by Mr. Hey, of Leeds, and which is most commonly met with in feeble, delicate persons, who have suffered from chronic disease of the knee. A sudden and forcible twist of the joint occasioned by striking the toes against a stone, or an accidental slip in walking while the foot is turned inwards and the thigh outwards, is the usual cause of the mishap. The lesion essentially consists in the partial removal of the semilunar cartilages from their natural position, allowing them to become wedged in between the tibia and femur, simply in consequence of the relaxed condition of their ligamentous connections. Occasionally, however, the wrench is so violent as to detach some of these connections from the bone.

Well marked *symptoms* always attend this form of luxation. The patient is suddenly rendered conscious of some accident, which causes him to feel faint and sick, and immediately compels him to sit down. The pain is very excruciating, and he is unable to stand, or to extend the limb, which is generally semiflexed. If the joint be examined within a few minutes after the occurrence of the injury its size and shape will be found to be perfectly natural, and the inexperienced surgeon will probably conclude that the case is one merely of slight sprain. In a short time, however, considerable swelling sets in, and the articulation before long imparts a distinct sense of fluctuation from a deposit of synovial fluid, consequent upon inflammation of its lining membrane. The excessive pain and shock are due to the pressure which the tibia and femur exert upon the displaced cartilages, in consequence of the changes in their mutual relations, and, also, to the forcible distension of some of the ligamentous structures of the joint. The dislocation, having once taken place, is extremely liable to recur from the most trivial causes; and under such circumstances I have repeatedly noticed that, although the patient was always obliged to keep his leg in a slightly bent position, yet he was able, when he sat on a high seat, to move it nearly as well as the sound one.

The *reduction* should not be attempted unless the patient is under the influence of chloroform, as otherwise it will be very painful. The most eligible position is the recumbent, the thigh being strongly flexed

upon the pelvis. The surgeon, placing his arm in the popliteal hollow, and grasping the limb just above the ankle, bends the knee suddenly and forcibly, and then rapidly extends it, at the same time imparting a movement of rotation to the leg. By this triple manœuvre the pressure of the condyles is taken off from the semilunar cartilages, and the parts are enabled to return to their natural situation. Sometimes the ingenuity of the patient will enable him to effect reduction when that of the surgeon fails. Sir Astley Cooper mentions the case of a gentleman who was in the habit of relieving himself by bending the thigh inwards and pulling the foot outwards, as he was sitting on the floor. In some instances, again, the parts are found to return of their own accord after the usual means have failed, either while the patient is seated, or lying asleep in bed.

It is always proper after such an occurrence that the joint should be kept for a few days perfectly at rest until it has, in some degree, recovered its original tone; and when the patient begins to exercise he should wear a laced knee-cap, and guard against any sudden twists of the limb, a recurrence of the dislocation being, as already stated, extremely prone to happen after all injuries of this kind. Sorbefacient liniments and the cold douche will be of service in promoting the removal of effused fluids, and imparting vigor to the relaxed structures.

DISLOCATIONS OF THE HIP-JOINT.

Dislocations of the ileo-femoral joint are far less frequent than those of the shoulder, a circumstance which evidently depends more upon the peculiarity of structure of these articulations than upon any difference in their motions, which are sufficiently free and varied in both, though certainly less so in the former than in the latter. The hip-joint affords the best type of the ball and socket joint with which we are acquainted. The acetabulum is of immense depth, and, therefore, furnishes ready accommodation to the large and well formed hemisphere which constitutes the head of the femur. The glenoid cavity of the scapula, on the other hand, is very shallow, and yields very inadequate support to the head of the humerus, in the varied and extensive movements of the shoulder. Besides, there is a great difference in the ligaments which bind the bones to each other in these articulations. The capsular ligament of the shoulder is comparatively weak, while that of the hip is by far the most powerful in the body, at the same time that it is most closely and firmly fitted round the parts which it is designed to retain and to protect. In addition to this, the latter has a ligament peculiar to itself, the inter-articular, which serves to connect the head of the bone directly to the margin of the acetabulum, an arrangement which is altogether wanting in the shoulder, the long head of the biceps forming a very imperfect substitute. Finally, the hip-joint is under the cover and protection of large and powerful muscles, which are much more capable of resisting the effects of dislocating agents than those of the shoulder, which, in fact, often rather promote the occurrence of the accident, if they do not actually produce it by their own ill-directed efforts.

The *infrequency* of dislocations of the hip-joint in the female, as compared with that of dislocations in the male, has been a subject of remark with all writers upon these affections, and has, therefore, a real and positive existence. Various hypotheses have been invented to account for this occurrence, but the only one, in my opinion, that is at all plausible is that which ascribes it to the difference of occupation in the two sexes. If women were as constantly exposed to all kinds of external violence, especially to falls and blows, as men are, we could not hesitate to believe that they would suffer quite as often, not only from luxations of the hip-joint, but from those also of the other articulations, which, however, as is well known, is far from being the case. Dislocations of the shoulder occur at least from six to eight times as frequently in the male as in the female, and in the ileo-femoral joint the difference is still more remarkable.

Age exerts an extraordinary influence upon the production of these accidents. It is a very uncommon thing to meet with a luxation of the hip-joint in children, because a degree of force capable of causing the mischief in the adult would be more likely to lead to separation of the epiphyses of the bone, owing to its imperfect development, and consequent inability to resist external injury. In the aged the lesion is also unusual, for at that period of life the osseous tissue being very brittle is extremely liable to be broken by the slightest causes. Hence, fracture of the neck and upper extremity of the femur is much more frequent in both sexes after the age of fifty-five than displacement of the head of that bone from the acetabulum. The accident often occurs in young men from twenty to twenty-five, but there is no time of life in which it is so frequent as in that which intervenes between twenty-five and forty-five. The youngest case of dislocation of the hip-joint with which I am acquainted has been related by Mr. Image, of England, as having occurred in a boy only three years and a half old. Sir Astley Cooper refers to one which happened to a child of seven, and Mr. Benjamin Travers, jr., saw a case at the age of five.

The head of the femur is susceptible of being dislocated in four principal *directions;* upwards, upon the dorsal surface of the ilium; backwards, into the sciatic notch; downwards, into the thyroid foramen; and forwards, upon the pubic bone. Of these displacements the first is by far the most common; next in order of frequency is that into the sciatic notch, and the rarest of all is the last. Sir Astley Cooper, whose experience in dislocations of the hip-joint was very great, estimated that out of every twenty cases twelve would be on the dorsal surface of the ilium, five in the sciatic notch, two in the thyroid foramen, and one on the pubic bone. I am sure that the observation of most surgeons must accord, in a general manner, with this opinion. To the extreme rarity of the last two forms of luxation every one can bear testimony. The reason of the great frequency of iliac dislocations is to be found, I presume, rather in the position in which the thigh is usually placed at the moment of the accident than in any differences in the structures of the hip-joint at particular portions of its extent, certain attitudes of the limb always favoring the occurrence of certain displacements.

Besides the varieties of luxations now enumerated, there are several others which, although extremely infrequent, are too important to be omitted in a systematic treatise on surgery. These will, therefore, be briefly described under another head, as rare, unusual, or anomalous dislocations of the ileo-femoral articulation.

It will greatly simplify the study of the four principal varieties of this accident if we describe them as the iliac, sciatic, thyroid, and pubic, terms which every one understands, and which cannot fail to convey a clear general idea of the locality of each displacement to which they refer.

All these luxations are *complete*, the head of the femur being always forced entirely out of its socket. Great violence is necessary for their production, and they always take place so much the more easily in proportion as the force is diffused over a large surface. I am not acquainted with a solitary instance in which they were the direct and immediate result of muscular contraction, as occasionally happens in dislocations of the shoulder-joint. Such an event could only occur where there was previous disease of the articulation, destroying its ligamentous connections. The violence may act either directly upon the hip, or indirectly through the knee or foot, and the nature of the displacement will depend upon the direction in which it is applied. Thus, luxation into the thyroid foramen can only be produced when the limb is powerfully abducted at the moment of the accident, and the occurrence will be promoted if the strain be increased by the person having a heavy weight upon his shoulder.

In every dislocation of the hip there must necessarily be extensive injury to the soft parts. The capsular and inter-articular ligaments are of course torn, and the same fate is nearly always shared by the rotator muscles of the femur. The two large gluteal muscles, however, and the psoas and iliac, which are attached to the small trochanter, usually escape, or are, at most, only put upon the stretch. When the external violence has been uncommonly severe, a considerable effusion of blood may be expected in and around the joint, and there will be likely also to be more or less contusion of the integuments and muscles, especially if the injury has been direct.

1. In the *iliac* dislocation, the head of the femur is thrown upwards and backwards upon the dorsal surface of the ilium, resting in the fossa of that bone, on the small gluteal muscle (fig. 282). In some cases, though rarely, it is thrust a good deal forwards instead of backwards.

The *signs* of the accident are sufficiently obvious, exhibiting rarely any material variation (fig. 283). The hip is considerably deformed, being more salient than naturally, the upper part of the thigh is unusually full, and the gluteo-femoral crease is on a higher plane than common. The great trochanter is carried upwards and inwards, in closer proximity with the anterior superior spinous process of the ilium, and is more conspicuous than in any other accident, except coxalgia. The head of the bone can be felt in its new situation, particularly in thin, lean subjects, and on rotating the thigh it is found to roll about under the finger. The limb is from an inch and a half to two inches and a half shorter than in the normal state; the foot is strongly inclined in-

wards, the big toe pointing towards the opposite tarsus; the knee, as the patient stands, is seen to be a little above and somewhat in advance of the sound one, any attempt to turn it out proving impracticable,

Fig. 282.

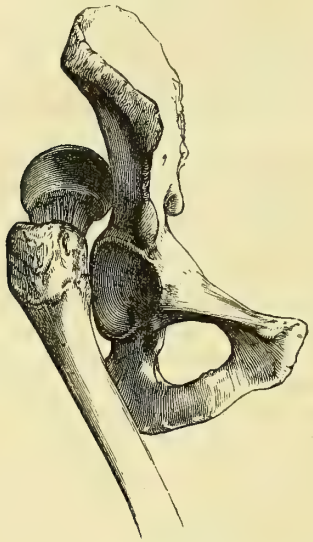
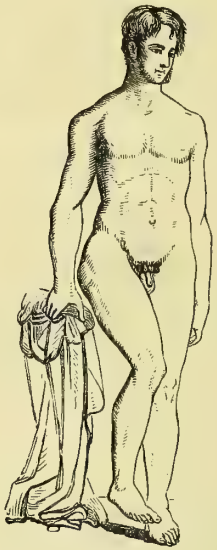


Fig. 283.



Dislocation on the dorsum of the ilium.

and causing severe pain; the thigh is slightly bent upon the pelvis, and may with a little effort be carried across the sound one; the leg is flexed upon the thigh; the heel is raised off the floor; and the limb, firmly fixed in its constrained position, cannot be restored to its proper length without reducing the dislocation, nor can it be moved except a little inwards. When the patient lies down, the foot rests on the bed, but the knee is considerably raised, and all attempts to extend it are found to be unavailing.

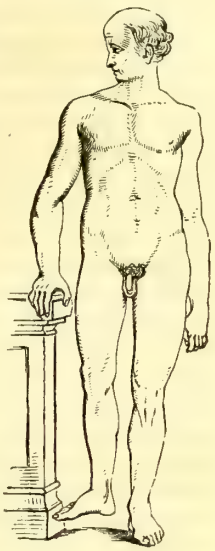
The luxation is generally occasioned by falls upon the knee or foot while the thigh is strongly adducted and thrown forwards beyond the line of the body. In this way the head of the femur, being powerfully rotated inwards, is thrust forcibly upwards and backwards, tearing the capsular ligament in that direction, escaping from the acetabulum, and lodging in the lower part of the iliac fossa, under the small gluteal muscle. The accident may also be produced by violence applied directly either to the hip or to the upper extremity of the femur, as by the fall of a heavy body, when the limbs are widely separated, and the trunk is inclined strongly forwards. The two obturator, geminal, square and pyriform muscles are greatly stretched, and sometimes even partially ruptured, while the psoas and iliac are both relaxed, as are also the adductor, pectineal and gluteal. The round ligament is of course torn. The powerful tension into which the external obturator muscle, a fleshy mass of large size and great strength, is thrown by the accident, is the immediate cause of the immobility of the limb, of

the inversion of the foot and knee, and of the excessive pain which follows any attempt at rotation and abduction.

The *diagnostic signs* of the dislocation are, the great prominence of the trochanter and its proximity to the anterior superior spinous processes of the ilium; the inverted and shortened state of the limb; the fixed position of the head of the bone in its new situation; and the impossibility of abducting and rotating the knee.

The only accident with which this luxation is at all likely to be confounded, is fracture of the neck of the femur (fig. 284), within the capsular ligament. In general, however, the diagnosis is established with great facility. All, in fact, that the surgeon has to do, is to remember that, in fracture, the trochanter is drawn backwards, and less salient than usual; that the foot is everted instead of being inverted, as in luxation; that the limb can be readily restored to its proper length by extension, but that it will immediately resume its former position when the extension is discontinued; and, finally, that, when the ends of the fragments are brought in contact with each other, crepitation may be promptly elicited by rotating the thigh. Moreover, the limb may be moved, although not without great suffering, in every direction, and not merely inwards and slightly upwards, as in dislocation.

Fig. 284.



Difficulty in regard to the diagnosis occasionally arises from injury of the superior extremity of the femur, attended with fracture of the great trochanter, in consequence of the detached fragment being drawn upwards and backwards, by the action of the muscles, into the fossa usually occupied by the head of the bone in luxation. The signs of distinction are, the mobility of the broken piece, the absence of inversion of the limb, and our ability to carry the thigh about in different directions, although not without severe pain.

The degree of shortening attending the iliac variety of displacement is best ascertained by extending a piece of tape, or a graduated measure, from the anterior superior spinous process of the ilium to the centre of the tuberosity of the internal condyle on each side. Or, instead of this, the tape may be carried along the middle line of the body, from the centre of the fourchette of the sternum to the sole of the foot, placed at a right angle with the leg. The difference in the result will indicate the extent of the defect. There is considerable variation in regard to the amount of shortening in different cases. On an average, it may be stated to range from two inches to two inches and a half; but occasionally it is as much as three inches and a half, and, on the other hand, as little as an inch and a half.

It is surprising that writers should invariably insist upon stating that there is less prominence of the great trochanter in this variety

of luxation than natural, whereas a little reflection will serve to convince any one that such an opinion is altogether untenable. To prove the truth of this remark it is only necessary to examine the position which the femur assumes in consequence of the dislocation. The whole limb being strongly rotated inwards, the trochanter, as it lies in its new situation just above the rim of the acetabulum, or partly above and partly below, is necessarily tilted up and brought forwards, so as to augment, in a very striking degree, its saliency beneath the integuments and muscles of the gluteal region. An excellent idea of the changes produced in the projection of the trochanter may be formed by alternately everting and inverting the foot strongly in the ordinary standing attitude, so as to make, on the one hand, the big toe of the rotated limb point against the opposite tarsus, and, on the other, against the hollow between the tendo-Achillis and the inner malleolus. In the former position, the bony eminence will be remarkably prominent, jutting out as a rounded mass, whereas in the latter it will hardly be perceptible, or, at all events, comparatively small. In displacement of the head of the bone upwards and backwards, the projection is abnormally distinct, and is, therefore, a sign of great diagnostic value.

The *reduction* of this dislocation, thanks to the researches of Dr. W. W. Reid, of Rochester, is no longer, as it once was, the dread of the surgeon and the terror of the patient. In a paper, characterized by great clearness of style, published in 1851, that gentleman showed, for the first time, by a series of admirably conducted experiments, dissections, and clinical observations, that the chief impediment to restoration is not, as was formerly supposed, the contraction of the muscles that are affected by the accident, but the indirect action of the muscles that are put upon the stretch by the malposition of the dislocated bone, and that the operation may always be safely, certainly, and expeditiously performed, simply by manual effort, without any assistants, pulleys, or, in short, any extraneous aid whatsoever.

In awarding to Dr. Reid the honor of this method of reduction, I am not unmindful of the circumstance that some of the older practitioners occasionally pursued a similar procedure; nay, that the method is even dimly shadowed forth in the writings of Hippocrates; that it was distinctly taught for a number of years by Dr. Nathan Smith, in his annual courses of lectures; that attention was called to the subject afterwards, namely, in 1831, by his son, Dr. N. R. Smith, of Baltimore, in his Medical and Surgical Memoirs; that Physick performed the operation successfully before his class early in the present century; and that, in later times, cases have occasionally appeared in the foreign medical journals, showing that it had also now and then succeeded in the hands of European surgeons. All this is matter of history. But Dr. Reid may justly claim for himself the great credit of having discovered the principle upon which the method is founded, and of having presented the whole subject in so clear and forcible a manner, to the notice of the profession, as to acquire at once its undivided confidence.

The operation, as performed by Dr. Reid, consists of certain pro-

cesses and evolutions, in which the shaft of the femur is employed as a lever, and the pelvis as a fulcrum, the object being, in the first instance, to dislodge the head of the bone from its new situation, and then to induce the muscles to pull it downwards and inwards into the acetabulum, thus compelling it, as it were, to retrace its steps along the route which it travelled in the dislocation. In conducting the operation, the most eligible plan is to make the patient lie upon the floor, as this affords a much firmer resistance than a lounge, bed, or low table, and gives the surgeon, moreover, a better opportunity of placing himself in any attitude that may be deemed requisite. The patient should be thoroughly anæsthetized, and if he be unusually stout and plethoric, it will not be amiss to bleed him copiously at the arm, as a preliminary measure, though, in general, this will not be necessary. In the female, exposure of the person is avoided by means of a sheet.

The operation may be described, for the sake of greater simplicity, as consisting of three stages. In the first, the surgeon, grasping the knee with one hand, and the leg just above the ankle with the other, flexes the thigh upon the pelvis, and the leg on the thigh, carrying the limb across the sound one, and the knee over the abdomen as high up as the umbilicus. In the second stage, the knee is turned outwards on a line with the injured side, a procedure which will draw the big toe from its inverted into an everted position, and of course incline the heel proportionably inwards, or in the opposite direction. In the third stage, the foot is carried across the sound limb, and the knee pushed outwards and downwards, when, the thigh being gently rotated, the head of the bone slips at once into its socket, with an audible jerk, and the injured limb resumes its natural position. The whole operation may usually be performed in less than two minutes. On one occasion, I am sure, it did not occupy me half that time. It is impossible to conceive of anything more simple, efficient, and philosophical, than the whole proceeding. As Dr. Reid justly observes, it not only relaxes the muscles concerned in the displacement, but it absolutely compels them by their own efforts to draw the bone into its proper position, making them thus, with a little effort on the part of the surgeon, the reducing agents.

2. The *sciatic* dislocation commonly results from falls or other violence applied to the foot or knee while the body is strongly inclined forwards upon the thigh, or the thigh upwards upon the pelvis. In either case the head of the bone, breaking through the posterior and lower part of the capsular ligament, slips backwards from its socket, and takes up its abode in the sciatic notch, resting upon the pyriform muscle, between the sacro-sciatic ligaments and the convex surface of the iliac bone. The capsular ligament is severed, and the psoas, iliac, and obturator muscles are put upon the stretch, and occasionally otherwise injured.

The *symptoms* of this dislocation bear so close a resemblance to those of the iliac that several late writers are disposed to regard them merely as modifications of the same lesion, the one being an exaggerated form

Fig. 285.



Dislocation into the sciatic notch.

of the other. I have myself always looked upon them as separate and distinct varieties, and shall, therefore, so consider them on the present occasion. The adjoining sketch (fig. 285) conveys an excellent idea of the appearances presented by the injured limb, and a comparison between it and the preceding will serve to show that they differ from those of the iliac luxation only in being less marked. The limb is shortened from half an inch to an inch, and so firmly impacted in its new position that it is impossible to bend or rotate it; the great toe rests against the ball of the sound one; the knee is turned in and advanced over the opposite one, but not so much as in the dislocation upwards; the trochanter, which is uncommonly prominent, is lower down than natural, and consequently further off from the crest of the ilium; and the head of the bone is so deeply buried in the sciatic hollow as to render it very difficult to detect it by the finger, except in thin, emaciated persons. Both the thigh and leg are slightly flexed.

The characteristic *signs* of the dislocation are the situation of the head of the bone behind and below the acetabulum, a short distance above the tuberosity of the ischium; the comparatively slight shortening of the limb; the firm impaction of the thigh in its new locality; and the unusual distance between the trochanter and the spine of the ilium.

In a case of sciatic dislocation which was recently under my charge, in a rather thin man, twenty-eight years of age, I took special pains to make a most accurate examination, and, from notes taken at the moment, I am enabled to append the following statement. The limb was nearly one inch shorter than the sound one, and strongly flexed at the knee. When an attempt was made to bring the thigh and leg in a straight line, the man complained of severe pain, and immediately raised his loins, so that it was quite easy to pass the fist and arm underneath. When the body was extended, the knee became immediately bent, just as it was at the time of the accident. The limb lay close by the side of its fellow, and could neither be carried backwards nor outwards, but was easily flexed on the pelvis. When the man stood up, he threw his body very much forward, and the limb hung close by the side of the other, the knee being far in advance of the sound one, and crossed somewhat over it; the foot was almost parallel with the other, but the heel was raised from the floor nearly two inches. Both in standing and lying the trochanter was at least one inch further off from the anterior superior spinous process of the ilium than the opposite one, besides being unusually prominent; and the head of the femur could be distinctly felt on the dorsal surface of the ilium, at the

upper part of the sciatic notch, rolling under the finger when the limb was rotated upon its axis.

The following case of unreduced sciatic dislocation of the left side, which I had an opportunity of dissecting some time ago, will serve to illustrate the morbid anatomy of this form of injury. The patient was a man, aged twenty-five, who had met with the accident more than eight years previously.

The knee and foot were much inverted, there was shortening of nearly one inch and a half, and the whole limb had a wasted aspect. The external gluteal muscle was nearly normal, but the middle and internal were excessively atrophied, shortened, and confused together, their fibres being very pale, sparse, and partially transformed into fatty and fibrous tissue. The pyriform, also much reduced in size, was stretched over the head of the femur, and inseparably blended with the inner and middle gluteal. The geminal muscles and the tendon of the internal obturator were elongated, and twisted round the neck of the bone. The quadrate was lengthened, but not otherwise perceptibly changed.

The great trochanter was three inches and a half from the anterior superior spinous process of the ilium, and four inches and a half from the crest of that bone, its top being on a line perpendicular with it.

The head of the femur lay across the upper part of the sciatic notch, being two inches from the tuberosity of the ischium, and a few lines from the posterior inferior spinous process of the ilium, its distance from the crest of that bone being two inches and three-quarters. It was nearly completely divested of cartilage, and very rough, being studded with numerous little bony eminences. Surrounding it was a false capsule, varying in thickness from a fourth of a line to a line and a half, and composed principally of the remnants of the pyriform and the two small gluteal muscles; it was translucent at several places, rough on its inner surface, with here and there a serous, glistening point, and presented a large quantity of reddish filamentous tissue, just below the head of the bone, to which and to its neck it was firmly adherent. The ilium and sciatic ligaments which accommodated the bone were sound, and it was evident, from the manner in which the parts had been impacted, that but little motion existed after the accident. The acetabulum was nearly filled by a fibro-cartilaginous substance, its edges having been rounded off by absorption. No trace could be discovered of the capsular and round ligaments.

Fig. 286.



3. In the *thyroid* dislocation, the head of the femur is thrown downwards and forwards into the thyroid foramen (fig. 286), resting upon the external obturator muscle by which that opening is covered in, the

great trochanter being turned backwards towards the acetabulum. It is caused by falls upon the foot or knee while the thigh is widely separated from its fellow, and inclined sharply backwards. It may also be occasioned by a heavy body, such, for example, as a sack of corn, striking the hip while the limb is in a state of abduction, and the trunk bent forwards. The gluteal muscles are drawn downwards, considerably flattened, and put upon the stretch; the pyriform is elongated and tense; the inter-articular ligament and the lower portion of the capsular ligament are torn; and the extensor muscles of the thigh form a hard, firm mass, reaching from the pubic bone to within a short distance of the knee.

The *symptoms* are remarkably prominent and distinctive (fig. 287). The hip has lost its convexity, and in place of the projection formed by the trochanter there is a decided flattening, and sometimes even a positive depression; the trochanter, moreover, is removed considerably further from the anterior superior spinous process than in the natural state. The limb is increased in length from an inch and a half to two inches, and, owing to the tension of the gluteal muscles, stands off in an awkward and constrained manner from the sound one, the knees being in consequence widely separated from each other. The trunk is bent forwards by the action of the psoas and iliac muscles, which are greatly stretched; and a large tumor is perceptible in the region of the thyroid notch, caused by the presence of the head of the femur, which, however, can only be felt distinctly in thin subjects, and in the absence of swelling. The knee is flexed, and much in advance of the sound one, and the foot, usually a little everted, is widely separated from its fellow. The movements of adduction, extension, and rotation are impracticable, but those of abduction and flexion may be executed by the surgeon, although not without excessive suffering.

Fig. 287.

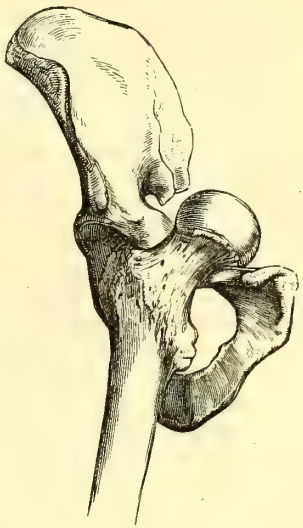


Dislocation into the thyroid foramen.

When the patient stands erect and is viewed in profile, the body and limbs are found to form an obtuse angle with each other, owing to the contraction of the gluteal muscles, on the one hand, and to that of the iliac and psoas on the other, the latter forming at the same time a tense ridge on the side of the thigh, perceptible both to sight and touch; the toes rest on the floor, while the heel is usually somewhat elevated; the hip, by its flattened condition, contrasts strikingly with its fellow; the femoro-gluteal crease is lower down than natural; and the knee is observed to be greatly in advance of the opposite one. If the patient be requested to extend his body so as to bring it on a line with the thighs, he will find himself incapable of doing it, and will suffer severe pain in consequence of the attempt.

The *diagnostic* signs are the widely separated state of the knees, the elongation of the limb, which does not exist in any of the other luxations of the hip, the forward inclination of the body, the flattened state of the nates, the excessive tension of the iliac and psoas muscles readily felt by the finger, and the impossibility of adducting, extending, and rotating the leg. Another good sign is afforded by the great trochanter, which will be found to be farther off from the anterior superior spinous process of the ilium in dislocation than its fellow is on the opposite side.

Fig. 288.



4. The *pubic* variety of dislocation is extremely uncommon, and might therefore almost be classed among the rare forms of the accident. As the name implies, the head of the femur lies upon the horizontal branch of the pubic bone (fig. 288), above Poupart's ligament, and external to the femoral vessels, under cover of the iliac, psoas, and straight muscles. The displacement is caused by falls while the limb is pushed backwards and outwards, and there is a heavy load upon the shoulder, as when a man carries a bag of wheat, and his feet suddenly give way under him. Another mode in which it may be produced is by the sudden bending of the body backwards, while the foot is implanted in a ditch or hollow, and the femur is kept straight by the action of its extensor muscles. Under these circumstances the head of the bone ruptures the upper and inner portion of the capsular ligament, and slips out of its socket into the situation adverted to.

Fig. 289.



Dislocation on the pubes.

In this luxation the limb is about an inch shorter than the other; the foot and knee are everted (fig. 289), and separated from their fellows, though in a less degree than in the thyroid displacement; the buttock is flattened; the great trochanter lies nearer the middle line than naturally; the femoro-gluteal fold is above its ordinary level; and a distinct prominence, hard, rounded, and easily impressed by rotating the leg, exists in the groin, just above Poupart's ligament, representing the head of the femur. Adduction and rotation inwards are impracticable. In a case of pubic dislocation seen by Physick, in 1805, the head

of the bone lay beneath Poupart's ligament, and the limb was a little longer than the sound one.

The flattening of the buttock, the slight shortening of the limb, the eversion of the toes, the impossibility of rotating the thigh, and the existence of the head of the bone in the groin, are marks which sufficiently characterize the accident to prevent mistake.

General Diagnosis.—If we compare these four varieties of luxations with each other, we shall find, with the exception of the first two, sufficiently broad marks of dissimilarity to render the diagnosis, with a little care, quite easy. The thyroid is the only one in which there is any lengthening of the limb; in all the others it is shortened, least in the pubic, and most in the iliac. In the iliac and sciatic the hip is abnormally prominent; in the other two it is flattened; in the former the knee and foot are inverted, in the latter they are everted, decidedly in the pubic variety, and generally very slightly in the thyroid. In all the head of the bone may generally, with a little care and patience, be perceived by the touch in its abnormal position, especially in thin persons, and before the occurrence of much swelling, rolling about when the leg is rotated upon its axis. The great points to be attended to, whenever there is any doubt respecting the diagnosis, are the state of the limb as to the change in its length, axis, and movements; the position of the great trochanter, especially its distance from the anterior superior spinous process of the ilium; and the location of the head of the bone and our ability or inability to feel it in its new situation. If the surgeon will only give proper heed to these considerations, he will seldom be long in doubt as to the character of the injury he is obliged to diagnosticate and treat. The investigation will, of course, always be materially facilitated by the use of chloroform.

When all the ordinary means, such as the most thorough and patient examination with the touch, sight, and mensuration, fail, the mystery may often be solved with the exploring instrument, inserted at various points of the hip, and moved about in different directions in search of osseous prominences and depressions. A long, slender needle, sinking in to a great depth in the natural situation of the acetabulum, would infallibly declare the absence of the head of the thigh-bone, as the existence of an unusual osseous tumor outside of that cavity would certainly indicate the location of that bone in its new position. As there are no important vessels or nerves in and about the hip, such a procedure would be entirely free from the danger of hemorrhage and even pain. My opinion, however, is that this method of exploration, although perfectly safe and easy of execution, will rarely be necessary in any case, the nature of the lesion being generally too well marked to elude detection.

GENERAL REMARKS ON REDUCTION.

Having already described what is, in my opinion, the most unexceptionable method of reduction in the iliac dislocation, it is only necessary to add that the same mode of treatment is applicable to the

other varieties. I restored by this method, three years ago, with the greatest facility, a sciatic luxation of seventeen days' standing, and cases have of late been reported in the medical journals where it was employed successfully and without difficulty in the thyroid and pubic forms of the accident. Indeed, there can no longer be any doubt that it is the only true method in all dislocations of the hip-joint, the only exception being in chronic cases; but even here it will probably be found that it will generally succeed, provided it be applied in a proper manner, and with the requisite degree of patience and perseverance. In a case of iliac displacement of one month's duration, which I had under my care in 1855, in a stout, muscular man, aged twenty-two, I succeeded perfectly, by manipulation alone, after complete failure with the pulleys employed for nearly an hour and a half, the patient being all the while thoroughly relaxed by chloroform.

In the pubic and thyroid dislocations, reduction has occasionally been effected by the heel in the perineum, the patient and surgeon lying in opposite directions, as in luxations of the shoulder. The pelvis being thus firmly fixed by the foot, extension is made by grasping the leg above the ankle, the limb being gradually carried over the sound one as the head of the bone approaches the cotyloid cavity. Or, instead of this, the leg may be flexed at a right angle with the knee, and a long, stout noose secured round the lower part of the thigh, and thrown over the operator's neck and shoulder, which will thus afford him much greater control over the limb. This method, however, which recommends itself by its simplicity, is only applicable in very thin, feeble subjects, offering but little muscular resistance.

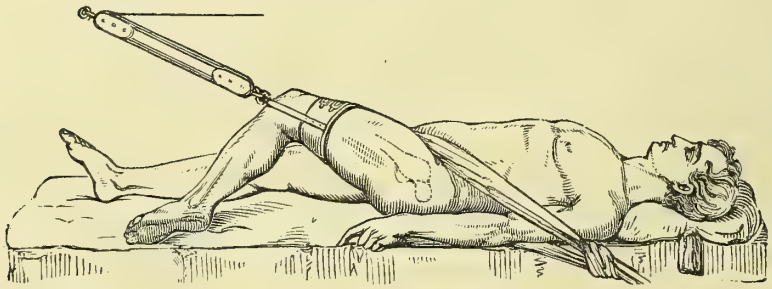
When manipulation fails, as I admit it occasionally will, especially in very stout, robust persons, and in cases of a chronic character, recourse must be had to the pulleys, for under such circumstances even severe measures would be preferable to leaving the dislocation unreduced, and letting the patient remain a cripple for life. The general principles which should guide the practitioner in the use of these instruments have already been pointed out. I shall, therefore, limit myself here to a brief description of the operation as applicable to the several varieties of dislocations of the hip.

The patient should be laid on his back on the floor, or on a firm table, lounge, or bed, between two strong objects, from ten to twelve feet apart, in each of which a large hook is fixed. A stout piece of muslin, neatly folded, soft, and at least four yards in length, is placed in the perineum, and being carried over the groin and buttock, its ends are tied together, and fastened to the hook behind the patient's head. Another band is carried round the upper part of the pelvis, and given to an assistant, its object being to prevent the injured hip from being drawn down during the operation. Finally, a large wet napkin is rolled round the lower part of the thigh, and over this is buckled a leather band, having two lateral straps provided each with a ring. Or, instead of the strap, a stout fillet is employed, being fastened by means of a wet roller, or the French knot, the ends being so disposed as to come down on each side of the knee, a little below which they

are to be tied. The knee being now bent nearly at a right angle, and inclined a little across its fellow, the pulleys, secured to the extending band and the staple, is put in motion by gently pulling at the cord. As soon as it is discovered that every part of the apparatus is put upon the stretch, and the patient begins to evince symptoms of suffering, as he will be sure to do if he has not taken chloroform, the efforts are to be relaxed, to allow the muscles time to become fatigued. After having waited a few minutes, the cord is again tightened, so as to increase the tension a little further, when the efforts are to be again intermitted. Taking care to proceed in this slow, gentle, and gradual manner, until the head of the femur has reached the edge of the acetabulum, the surgeon now entrusts the management of the cord to an assistant, while he himself, grasping the upper part of the leg, rotates the limb in a direction contrary to that of its displacement, and thus promotes the return of the bone to its socket, the reduction being generally indicated by a distinct snap. When the head of the bone hitches against the brim of the acetabulum, its disengagement may be materially facilitated by means of a fillet placed round the groin, and thrown over the operator's neck and shoulder, so as to enable him to lift the bone up to a level with the cotyloid cavity, into which it will then be drawn by the contraction of the muscles. The length of time during which the action of the pulleys is to be maintained must depend upon circumstances; in some cases the restoration is effected in a few minutes, in others not under several hours.

The annexed cut (fig. 290) illustrates the position of the patient

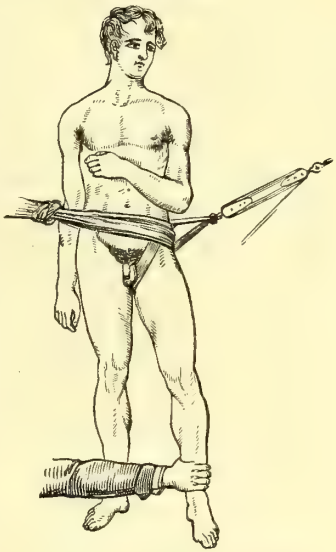
Fig. 290.



during this operation, the arrangement of the pulleys and extending bands, and the position of the limb.

In the iliac and sciatic dislocations the rule is to let the patient lie on his back, and, after the extension and counter extension have been kept up for some time, to carry the affected limb across the opposite one, as this enables the head of the bone the more easily to disengage itself from the brim of the pelvis. In the thyroid and pubic varieties the extension is directed downwards and backwards, the foot of the affected limb being carried behind the sound one, and the patient lying upon the uninjured side. The manner of conducting the proceeding is represented in the adjoining cuts (figs. 291 and 292).

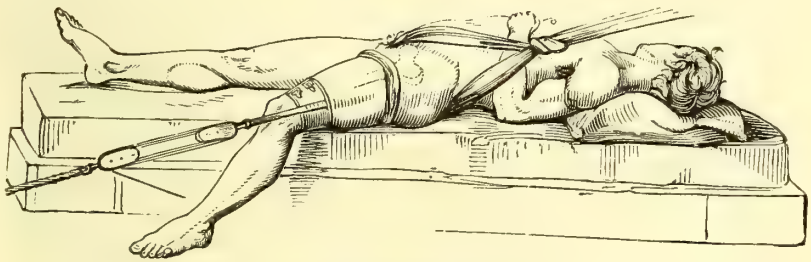
Fig. 291.



Reduction of the thyroid dislocation.

In our attempts at reduction, it occasionally happens that the head of the bone, instead of returning to its socket as it is being lifted out of its abnormal position, drops into some other, from which it is found to be more difficult to dislodge it than it was in the first instance. This accident is most liable to occur in the iliac luxation, which, as the head of the femur is moved about to disengage it from the iliac fossa, is readily converted into the sciatic. Occasionally the pubic displacement is changed into the thyroid; and an instance recently happened at the Pennsylvania Hospital, in the service of Dr. Neill, in which, during the reduction, the bone was thrown out of the thyroid foramen into the sciatic notch, from which it could only be returned afterwards, with great difficulty, by means of the pulleys. These accidents are generally unavoidable; but a knowledge of the possibility of their occurrence should put the surgeon upon his guard, that he may not

Fig. 292.



Reduction of the pubic dislocation.

be deceived under an idea that he has effected reduction when he has only succeeded in producing another displacement.

When the head of the bone has resumed its original position, as may always be known by the disappearance of the symptoms, and by a comparison of the length of the limb with that of its fellow, a return of the accident is to be prevented by keeping the thighs close together by means of a handkerchief or strip of bandage tied just above the knees. Recumbency will be necessary for at least three weeks; and during the first eight or ten days the hip should be kept constantly covered with cloths wrung out of a hot solution of acetate of lead and laudanum. If the inflammation run high, leeches, active

purgation, the antimonial and saline mixture,and even general bleeding may be demanded. After the morbid action has measurably subsided, sorbefacient lotions, and passive motion of the joint will be required, to promote the removal of plastic matter, and prevent anchylosis.

It is seldom that any of the luxations of the hip recur after the bone has been properly replaced, for such is the depth of the acetabulum and the nice adaptation of the head of the femur as to render an event of this kind extremely difficult after recovery from the immediate effects of the injury. A remarkable instance, however, occasionally occurs, in which the same displacement happens many times in pretty rapid succession in the same person. Thus, Mr. John F. South, of London, gives the case of a woman, who, in the space of thirteen years, dislocated her femur upwards and backwards upon the ilium not less than twenty-one times; latterly from so trivial a cause as stooping, or turning in bed. The accident first happened when she was twenty-four years old, in consequence of her slipping down on a piece of orange peel.

ANOMALOUS DISLOCATIONS.

The hip, like the shoulder, is subject to certain forms of displacement, to which, from the infrequency of their occurrence, the term rare, irregular, or anomalous may be applied. They are perhaps, for the most part, merely exaggerated states of the more ordinary varieties of the accident, as will be rendered evident from the annexed account, comprising a succinct outline of the principal reported cases. In a majority of these the head of the femur was thrown downwards against some portion of the ischium, in one it was lodged in the perineum, and in one it was pushed upwards and inwards against the ilium, lying in the space between its two anterior superior spinous processes.

In a case which happened to Mr. Robert Keate, the head of the bone lay close to, and on a level with, the tuberosity of the *ischium*, where it could be distinctly felt rolling about under the finger on moving the thigh, which was more than three inches longer than natural, much flexed upon the pelvis, and widely separated from the sound one. The leg was greatly bent, the foot much everted, and the large trochanter extremely sunk. By drawing the upper part of the femur outwards, and pressing the knee sharply inwards, the head of the bone returned to its natural place, with a decided snap. Immediately afterwards, however, the limb could be elongated by slight traction, inducing the belief that a portion of the cartilaginous rim of the acetabulum had been broken off in the accident, which had been caused by the man falling from his horse into a deep, narrow ditch, the animal tumbling backwards upon him.

A case has been described by Mr. Thomas Wormald, in which the head of the femur was dislocated downwards and backwards upon the upper part of the *tuberosity* of the ischium, above the quadrate

muscle. It was caused by a leap from a third story window, and was attended with other injury, which soon proved fatal. The head of the femur was easily recognized in its new situation. The limb, considerably shortened and inverted, formed half a right angle with the body, and the shaft of the thigh-bone, crossing the pubic symphysis, was immovably fixed in this position.

Mr. Earle was called to a case, where the head of the bone lay upon the *spine* of the ischium; the limb was lengthened about half an inch, but there was neither eversion nor inversion; the trochanter was farther back and less prominent than natural; an extraordinary vacuity existed in front of the hip; and the outline of the sartorius and tensor muscles was uncommonly distinct, their edges being tense and almost sharp.

Dr. Kirkbride, of this city, met with an instance where the head of the femur rested upon the posterior part of the *body* of the ischium, between its tuberosity and spine. The thigh lay across the sound one, the leg was flexed, the limb was lengthened at least an inch, and the interval between the great trochanter and the anterior superior spinous process of the ilium was much increased. Rotation was difficult, and extension impossible. The head of the bone was easily felt in its new situation. The reduction was effected by the pulleys, but not without difficulty, for the man was very muscular, and the bone was firmly impacted. The accident was caused by a fall from a considerable height, in which the body was crushed by a heavy piece of timber.

Dr. J. M. Warren has met with two cases in which the head of the bone rested against the ascending *ramus* of the ischium, the thigh projecting out laterally at a right angle with the trunk. A deep hollow existed at the spot naturally occupied by the great trochanter. The reduction was effected, in one case, by manipulation, in the other, by the pulleys.

Professor Willard Parker has reported a case of dislocation of the femur down into the *perineum*, which happened to a man, aged thirty-five, in caulking a boat, his body being bent strongly forwards and his feet widely separated. While in this position, the boat fell upon him, throwing him down by the side of the timber over which he had been standing, so as to force the right thigh between it and the bottom of the vessel. When extricated from this position, the left limb was found to project at a right angle with the trunk, the nates being flattened, and the toes turned slightly inwards. The head of the bone, upon rotating the thigh, could be distinctly felt in the perineum behind the scrotum, and near the bulb of the urethra. The reduction was readily effected by confining the pelvis, and extending downwards and outwards, aided by moderate rotation. In this way the head of the bone was made to ascend over the ramus of the pubes into the thyroid foramen, from which it was afterwards conducted into the acetabulum by carrying the limb strongly across the sound one.

Several cases have occurred in which the head of the femur was dislocated upwards and inwards into the space between the two ante-

rior *spinous processes.* In one, examined by Mr. Morgan, the bone lay in this precise spot, and could be distinctly felt under Poupart's ligament, upon the brim of the pelvis. The prominence of the great trochanter was entirely lost, the thigh was shortened at least two inches, the toes were excessively everted, and the injured limb had a tendency to cross the sound one. Rotation was impossible, but all the other motions could be performed, though only in a limited degree, and not without great pain. Reduction was easily effected. A similar case has been described by Mr. Benjamin Travers, jr., caused by a fall from a height of twenty feet, in which the left buttock struck upon a coil of chain cable. Here, however, the neck, and not the head of the bone, lay between the two anterior spinous processes, the head not being perceptible. The left nates was flattened, and the limb, shortened and everted, had the appearance, when the patient stood erect, of being suspended from the anterior and lateral part of the ilium. A little below and to the outer side of this point was the great trochanter, easily distinguished by the finger.

Lately a case occurred to Mr. Luke, at the London Hospital, in which the head of the bone was lodged midway between the thyroid hole and the ischiatic notch, immediately beneath the lower border of the acetabulum. The limb was lengthened one inch, without eversion or inversion, and the head of the bone was easily felt in its new position. The reduction was accomplished without difficulty. The man dying from the effects of other injuries, the dislocation was reproduced in the dissection of the joint. The inferior gemellus and square femoral had been torn, the lower part of the capsular ligament had given way, and the round ligament was completely detached. The patient was a stout man, fifty years of age, and the accident was caused by a fall into a dry dock.

The above cases will serve as types of most of those anomalous forms of ileo-femoral dislocations that will be likely to occur in practice. The symptoms which attend them are usually prominent, if not positively characteristic. The treatment must be conducted according to the general principles which guide the practitioner in the management of the ordinary varieties of luxation of the hip-joint. Manipulalation alone will frequently suffice to effect reduction, as there is always necessarily extensive rupture of the soft parts; where greater force is required, recourse must be had to the pulleys. In some of the cases above mentioned, the restoration was effected by a kind of compound process, the dislocation being first changed into a common one, from which the head of the bone was afterwards returned to its natural position by a second effort.

CHRONIC DISLOCATIONS.

Chronic dislocations of the hip-joint are occasionally brought under the observation of the surgeon, and the question, therefore, necessarily arises, when should such displacements be considered as irre-

ducible? It has been seen elsewhere that Sir Astley Cooper asserts that, as a general rule, it is imprudent to attempt restoration after the eighth week, except in persons of a debilitated frame, or very lax habit of body; and most English and American surgeons, adopting this view, have inculcated similar precepts. I believe this opinion to be in the main correct, and it may even be assumed that there are not a few cases which will resist all efforts at reduction long before the expiration of this period. In an especial manner is this true of the dislocations backwards into the sciatic notch and downwards into the thyroid foramen, in which the head of the femur becomes much sooner firmly and immovably fixed in its new position than in the iliac and pubic varieties. Sir Astley Cooper himself admits the existence of exceptions, and he has published the particulars of a case of luxation, upon the dorsum of the ilium, reduced after the lapse of five years. Numerous instances of a similar purport, only of much shorter duration, have been narrated by other writers, all tending to show that there are circumstances in which reduction may be hoped for after a joint has been out of place for several months.

It is not necessary to repeat here what has elsewhere been insisted upon in regard to the considerations which should influence the surgeon in the choice of his cases; or, in other words, the circumstances which should induce him to attempt or decline interference. Full instruction has already been given upon this subject, and yet, in view of its paramount importance, it may not be amiss to subjoin a few remarks, if it be only for the purpose of insuring greater care and caution.

The circumstances which may usually be considered as forbidding any efforts at restoration are, first, the absence of mobility in the luxated bone; secondly, occlusion of the acetabulum by fibrinous deposits; and thirdly, great disorder of the general health, rendering it probable that the system could not withstand the shock and irritation following the operation.

The first of these points can usually be determined by moving the limb about in different directions, and watching the degree of displacement suffered by the femur. The examination should be conducted by taking hold of the knee, or, better still, of the knee and ankle, and it will be most efficient if, while the limb is rotated, or attempted to be rotated, the hand be applied to the head of the luxated femur. When there is no motion, or motion only in a limited degree, it may be assumed that the adhesions are too strong to admit of rupture without risk of serious injury to the parts.

It is not always, indeed not generally, easy to determine whether the acetabulum has been filled up or not by plastic deposits. The probability of such an occurrence may be inferred if the accident has been followed by severe inflammatory action, if the parts have ceased to be tender on pressure, and if the head of the bone has contracted firm adhesions to the surrounding tissues. If any doubt remain, the exploring needle might be used, its point being carried about in different directions, to ascertain the amount and consistence of the obstructing substance.

It may be stated that, other things being equal, the acetabulum will be filled up much sooner in young, robust subjects, than in the aged and feeble, and that, as a general rule, the likelihood of its being so is always in proportion to the length of time that may have elapsed since the occurrence of the displacement.

Finally, the patient's health may be so much reduced as imperatively to prohibit all attempts at reduction, not on account of any pain that might be experienced, for chloroform would prevent all that, but because so much violence might be done in the operation as to cause the most intense inflammation and constitutional irritation, placing life in imminent peril.

When it is deemed advisable to undertake the treatment of such cases, it will generally be necessary to use the pulleys, subject to the rules and regulations already laid down for their employment; but sometimes the object may readily be attained, or, at all events, without much difficulty, simply by manipulation. Thus, Dr. Dupierris, of Havana, met, not long ago, with a case of iliac luxation of six months' standing, in which he succeeded most satisfactorily by this method alone; and a number of instances of a character nearly equally remarkable have occurred in the practice of other surgeons. Such examples are full of instruction, and deserving of the most attentive consideration, conveying, as they do, a highly valuable practical lesson. Nevertheless, they must be regarded merely as exceptions, nothing more: to view them as rules would be to contravene the laws of morbid action, and would, practically, lead to the worst results.

CONGENITAL DISLOCATION.

Congenital luxation of the hip-joint is sometimes met with, though on the whole a very rare affection, especially in this country. Female children are more apt to suffer from it than males, and it is also more common in such as are of a scrofulous habit than in such as are endowed with a good constitution. Of twenty-six cases of this malformation observed by Dupuytren, only four were males; a disproportion probably not altogether dependent upon chance. The immediate causes of this variety of displacement are, first, shortness, total absence, or extreme obliquity of the neck of the thigh-bone; secondly, partial or entire obliteration of the cotyloid cavity; thirdly, deficiency, extraordinary elongation, or complete absence of the round ligament.

The *characters* of this malformation are, shortening of the affected limb, unnatural projection of the great trochanter, ascent of the head of the femur into the iliac fossa, inversion of the leg, and obliquity of the pelvis. The motions of the joint, particularly those of abduction and rotation, are constrained and imperfect; the muscles of the upper part of the thigh are retracted, or drawn towards the iliac crest; the

limb is thin, wasted, and out of all proportion to the rest of the body; the tuberosity of the ischium is almost uncovered, and consequently unusually prominent; the upper part of the trunk is thrown backwards, while the lumbar portion of the spine projects forwards, being concave behind; the pubes is placed almost horizontally on the thighs; and the ball of the foot alone touches the ground when the child stands erect.

In the recumbent posture, when the weight of the trunk is taken off, and the muscles are relaxed, most of the symptoms of the luxation disappear, and the limb may be shortened or elongated at pleasure. In walking, the body is inclined towards the sound side, and the head of the dislocated bone sinks towards the cotyloid cavity by its own weight. As age advances, the limb becomes shorter, in consequence of the femur ascending higher and higher on the ilium; the obliquity of the pelvis augments; and the power of locomotion, already so much impaired, is completely destroyed.

Congenital dislocation of the hip-joint may, in general, be easily *distinguished* from other accidents or maladies, by the affection being observed at or soon after birth, by the obliquity of one or both thighs; by the absence of pain, swelling and ulceration; by the head of the femur being displaced without any external violence; and by the ability of the surgeon to lengthen or shorten the limb at pleasure. In disease of the hip there is always more or less pain, with a feverish state of the system, and gradual failure of the strength; the parts about the joint are tense and swollen; the limb, at first somewhat lengthened, becomes afterwards shortened, and cannot be extended without the greatest suffering; and the motions of the ileo-femoral articulation are permanently impaired.

The *pathological* appearances vary. In general, the cotyloid cavity is partially obliterated, or entirely deficient, being replaced by a small, irregular, osseous prominence, devoid of cartilage and synovial membrane; the head of the femur, often flattened at its antero-internal aspect, rests in a sort of superficial fossa on the dorsal surface of the ilium; the round ligament, as was before remarked, is elongated, partially worn away, or even altogether absent; and the surrounding muscles are either atrophied, transformed into a yellowish, fatty, fibrous tissue, or preternaturally developed. In the latter case, their action is preserved; in the former, it is very much restricted, or totally annihilated.

The *prognosis* is always unfavorable, as the patient dies either young, or remains permanently lame and deformed.

The *treatment* of congenital dislocation of the hip-joint can generally be little more than palliative. In cases of recent standing, permanent extension, by means of Desault's fracture apparatus, or some other suitable contrivance, may be tried with a prospect of advantage, though seldom with a hope of permanent cure. When both joints are involved, the patient should be kept for a long time in the recumbent posture, in order to take off the weight of the body from the

limbs, as this is the main agent in aggravating the displacement. As an important auxiliary measure, recourse may be had to the shower-bath, followed by dry friction, or friction with ammoniated and other stimulating liniments. The pelvis may be encircled with a broad, well-padded belt, so as to steady the trochanters, and counteract the tendency of the thigh-bones to ascend towards the iliac crests. If debility exist, tonics will be required, especially quinine and some of the preparations of iron.

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